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AUTHOR Ndunda, Mutindi Mumbua Kiluva
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ABSTRACT

Using the perspective of gender, this study examines the views of science and science-related careers held by students in Kenya. The study is directed at exposing the experiences that girls have of school science education within the historical and cultural context of Kenyan society. The rationale for the study draws on findings showing that education for women in Kenya lags behind that for men, particularly in science education. The study involves 20 students (16 females and 4 males) from 2 schools in Nairobi (Kenya). The students were in their third year of secondary education and studying pure science subjects. The data, which consists of 30 interviews and 2 classroom observations, were collected during a 3-month period in the summer of 1989. The data were analyzed and explored for factors which could deter female students from studying science in high school and from pursuing science and science-related careers. The study showed that boys' and girls' experiences of school science education differ in specific and gender related ways. These differing experiences affect directly boys' and girls' self-perceptions of their ability to study science in high school and to pursue science and science-related careers. Girls in the co-educational school were more likely than boys to have negative experiences of science education. Girls in the single-sex school reported positive experiences with science and held more egalitarian views about women's ability to study science and to pursue science-related careers. Analysis of the data suggests an overall interpretation that young women resist science careers because of the potential conflict with their future roles as wives and mothers in Kenyan society. (Author/CW)

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"BECAUSE I AM A WOMAN":

YOUNG WOMEN'S RESISTANCE TO SCIENCE CAREERS IN KENYA

by

Mutindi Mumbua Kiluva Ndunda

A thesis submitted to the Faculty of Education

in conformity with the requirements for

the degree of Master of Education

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Abstract

Using the perspective of gender, this study examines the views of science and science-related careers held by students in Kenya. The study is directed at exposing the experiences that girls have of school science education within the historical and cultural context of Kenyan society. The rationale for the study draws on recent findings showing that education for women in Kenya lags behind that for men, and particularly in science education.

The study involves 20 students (16 females and 4 males) from two schools in Nairobi. The students are in their third year of secondary education and are studying pure science subjects. The data, which consist of 30 interviews and two classroom observations, were collected during a three-month period in the summer of 1989. Data are analyzed and explored for the factors that could deter female students from studying science in high school and from pursuing science and science-related careers.

The study shows that boys' and girls' experiences of school science education differ in specific and gender-related ways. These differing experiences affect directly boys' and girls' self-perceptions of their ability to study science in high school and to pursue science and science-related careers. Girls in the co-educational school are more likely than boys to have negative experiences of science education. On the other hand, girls in the single-sex school report positive experiences with science and hold more egalitarian views about women's ability to study science and to pursue science-related careers. Analysis of the data suggest an overall interpretation that young women resist science careers because of the potential conflict with their future roles as wives and mothers in Kenyan society.

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This thesis is dedicated to my husband, Thomas Ndunda, our children, Nthenya and Ndambuki, and to my mother!

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CHAPTER 1

INTRODUCTION AND OUTLINE OF THE STUDY

This study is a qualitative exploration of how female students in urban Kenya make sense of the experience of science education and how their possibilities and constraints to pursue science and science-related careers are constructed. The rationale for the study draws support from existing literature and research findings showing that both world-wide and in Kenya, women are under-represented in education, particularly in science and mathematics education. In addition, my personal experiences as a female science student in both high school and university, and as a science teacher in high school, served as an impetus for the questions I raise in this inquiry. The study presents interview data and examines them in the light of the historical and cultural background of Kenyan society. Data are analyzed in terms of two sites of struggles: in the high school classroom, and in the family-career dichotomy. The conclusions suggest the need for more research and for policy development if we are to redress the female students' exclusion from science and increase career opportunities for female students. The power of the study resides in its transcending the usual pattern of explaining students' behavior by blaming them for underachieving in science subjects. The study attempts to make the female students' "everyday world" visible as a basis for change within the Kenyan context.

Gender and Science in Kenya: A Research Problem

Education influences individuals' economic participation and earning power and increased education increases these opportunities. With regard to women, statistics from around the world indicate that education of women lags behind that of men. Women are significantly

under-represented in science and science-related fields. In Africa, education of women lags behind that of men and the disparities between males and females in science and science-related careers are even greater (Eshiwani, 1983).

Achievement by girls at various levels of education determines their representation at higher levels of education, particularly in science and mathematics. Studies in the developed countries and elsewhere have consistently shown that girls' achievement in science classes falls below that of boys. Girls' science achievement has been found to decline between ages 9 and 14, and boys score higher than girls in high school science (Kahle, 1985; Johnson, 1987; Hardin & Dede, 1978).

In Kenya, only a small number of women pursue science and science-related careers in the universities. Thus there are very few Kenyan females in significant science-based careers such as engineering, medicine, and computer science (Eshiwani, 1983). For example, at the University of Nairobi, the faculty of Engineering enrolled 520 males and only 8 females (1.5 % of the total) in the 1980/81 academic year and 801 males and 23 females (3% of total) in the 1987/88 academic year (Eshiwani, 1988, p. 9). While this is a large increase as a percentage, it is indicative of the general situation that this study explores: females participate at very low rates in science-related professions.

The education system is obviously connected to the career options that students can pursue in university, and students who do not study science in high school cannot pursue science and science-related careers in university. The Kenya government identified this problem, and as a result, its restructuring of the education system from 7-4-2-3 (seven years primary, four secondary, two higher, and three university) to 8-4-4 (eight years primary, four secondary, and four university) also mandated science and mathematics for all students at the secondary level of education. This change was intended to encourage girls towards science education and science and science-related career options (Ministry of Education, Science and Technology, 1984). Although the Government of Kenya has made the study of science compulsory at the

secondary level and all students must study biology, students have the option to study "pure" physical science subjects—physics and chemistry—or physical science—an un-enriched combination of physics and chemistry. Only by studying pure science in high school will students have the opportunity to pursue science and science-related careers in university. As this study reveals, it is not evident how the move to make science compulsory will change the factors that lead to girls' under-representation in science.

Purpose of the Study

The purpose of the study is to explore female students' views of science in Kenya. Within this general framework, the study seeks to explore the following specific questions:

1. What discursive forms do girls use to describe science and scientists?
2. What are the reports of experiences that girls have of school science education; are these reports of experiences different from those experienced in other school subjects, and, if so, what reasons do they give?
3. What messages about their ability to do science and math do girls infer from their teachers? What are the students' views of these messages?
4. What are the girls' views about science as a viable career option?
5. Do the views expressed by the students suggest attitudes that could be associated with the historical and cultural legacy of Kenyan society?

These questions help in understanding the meanings that female students make of their experiences of science education. They place in context, the personal experiences of these students and help to identify some of the factors that lead to girls' exclusion from studying science in high school and influence their career anticipations. Four male students were also interviewed. The responses of the male students to these questions enrich the context of the girls' meaning

making about their experiences of science education and career anticipations. The study attempts to identify factors that influence female students' views of science, and seeks to explore how female students' opportunities and constraints to pursue science and science-related careers are constructed within the Kenyan context.

The study documents the experiences of female and male students of science education in a co-educational school, and those of female students in a single-sex school. The images that students have of science education, scientists and the possibility of pursuing a career in science appear to be influenced by their experiences of everyday life in school and outside school. These images seem to be a result of the social relations within which these experiences occur—the historical, cultural, and economic context of Kenyan society.

The focus of the study is mainly on female students' views of science. The views that the girls hold about science are assumed to be influenced by factors within the school and outside the school. The female students' views are expected to identify some of the factors that lead to girls' assumed underachievement in science and under-representation in science and science-related careers in Kenya.

Rationale

In Kenya, the differences between boys and girls in science enrollment and achievement have been very evident and have been a major concern to educators and feminist groups. In recent years, there has been a national outcry by feminist groups concerning the low Kenyan female population in significant science-based careers such as engineering, medicine, and computer science (Eshiwani, 1983). However, it is not difficult to hypothesize that the small number of women in these careers is the result of the small number of female students who opt for science courses at the university, a carry-over from high school. The proportion of females becomes increasingly smaller as one ascends the education ladder. Consequently, the number of females eligible for science-oriented career opportunities remains small.

To illustrate, while I was doing my "A" level science course at Kega High School in Nairobi, the ratio of female students studying science to those studying arts subjects was approximately 1:7. The same ratio was probably apparent across the country, since Kega High School was one of the few "A" level schools that boasted the best science results in the national examinations for girls. Also, at university in Nairobi the representation of females during my undergraduate years was very small in chemistry and mathematics and even smaller in physics. The representation has not increased significantly, even though the university intakes have more than quadrupled over the last three years with the creation of two new universities (Eshiwani, 1988).

As a teacher who has taught math and chemistry for five years to both girls and boys at both ordinary and advanced levels, I have noticed that the girls do not feel as confident to take the sciences as do the boys. Although the choice to take physics and chemistry is open to them, most girls tend to take the "softer sciences" of biology and general science (an un-enriched combination of chemistry, physics and biology). The majority of those who opt for chemistry and physics perform very poorly during the course and also in the national examinations (Kenya National Examination Council, 1986).

Since independence in 1963, the government has set up three major inquiries to look into ways and means of achieving the national educational objectives. The presidential working party on the Second University (1981) recommended the restructuring of the education system from the 7-4-2-3 (seven years primary, four secondary, two higher, and three university) to an 8-4-4 system of education (eight years primary, four secondary, and four university). The former had little technical education and relied on rote learning and memorization. The latter was intended to have a heavier dose of technical education in the primary level and a technical line for most of the pupils parallel with a purely academic line for 20% of the pupils. The students graduating at every level would have some scientific and practical knowledge that could be utilized for self-employment, salaried employment, or for further training (Ministry of Education, Science and Technology, 1984).

With the adoption of the 8-4-4 system of education in Kenya in 1985, all secondary school students must take physics, chemistry, biology and mathematics. In the previous system, the first two subjects were optional. Because girls have been alienated from science, it becomes difficult for them to participate in science activities in ways that afford them the same benefits that accrue to boys. Past experience suggests that parity between the sexes in educational opportunities and access to science and science-related careers can be achieved only if the factors that alienate girls from science activities are identified, challenged and eliminated. In Kenya, students who attain higher passes in science and mathematics in university entrance examinations get better chances for entry into university. If the male students continue to perform better in science and mathematics, they will get the limited spaces available in the universities. The implications of this will certainly be the continuation of under-representation of women in science and science-related careers and higher education and the channeling of women into the support-type of jobs that are already dominated by women. Women in Kenya constitute more than half of the human resources required for effective national development. However, since the introduction of formal education, the general status of women in education and educational opportunities has lagged behind that of men.

Significance of the Study

The study demonstrates the ability of this research method in providing information on students' views of science. The power of the research is that the students begin to speak for themselves about their experiences of science and how the experiences and expectations take on personal significance. The study becomes an important vehicle for making known some everyday situations that female students experience that are assumed "normal" but could be steering them away from science and science-related careers. In addition, the study shows that there is need for more research of this type to be done to explore female students' experiences of science and the factors that interfere with successful study of science in high school and

subsequent pursuit of science and science-related careers. The findings of this study should be made known to educators, curriculum developers and teachers for the purpose of improving science teaching for girls and eliminating practices and factors that perpetuate gender stereotypes.

Overview of the Study

Chapter 2 describes the traditional and historical background of education in Kenyan society. Traditional education was replaced by "Western" forms of education introduced into Kenya by Christian missionaries and developed along gender and racial lines. This chapter concludes with descriptions of the two schools where data were collected.

Chapter 3 presents a literature review that includes studies on gender and science done in the developed world and in Kenya. In Chapter 4, the data gathering and analysis methods are discussed. Chapter 5 presents data on students' views of science in the following categories: students' experience of science education; images of science and scientists; science as a career option; family, paid work and partners. These categories arise from the data and are discussed in detail in Chapter 6. They show how female students struggle to study science in high school and their dilemma of balancing a career in science against the cultural norms of motherhood. Chapter 7 reviews the research methodology, summarizes the major findings, and identifies recommendations and implications of the study.

CHAPTER 2

HISTORICAL AND CULTURAL CONTEXT

This chapter presents the traditional and historical background of education of Kenyan society. Discussed first in this chapter is the format of traditional education that was replaced by a "Western" form of education introduced into Kenya by the Christian missionaries in the middle of the 19th century and developed along racial and gender lines. It is argued that the modern form of education did not encourage women to be primary producers in the modern sector as they were in the traditional setting, but encouraged them to be wives and mothers. The colonialists introduced new value systems that devalued what women had been doing in the traditional setting. Colonial education made available to Kenyan women emphasized needlework, homecraft and hygiene and agriculture. Men, on the other hand were offered the "more masculine" subjects such as industrial, technical, and science-related subjects. These were subjects that provided job opportunities outside the home. Thus Colonial education served to widen the gender rift and to increase inequalities in access to educational opportunities leading to careers in science, industry and technology.

The last two sections of this chapter describe the two schools where data were collected. These high schools were established during the colonial period along racial lines. One of the schools was established to educate children of the ruling class—the Europeans—while the other school was established to educate African children.

The Introduction of Western Education in Kenya

Western education was introduced into Kenya by Christian Missionaries around the middle of the 19th century. Before this, indigenous education played a vital and effective role in African life. Indigenous or traditional education, was based on the environment, and its aim was to conserve the cultural heritage of the family, clan and tribe; to adapt children to their physical environment and teach them how to use it; to explain to them their own future and that of their community depended on the perpetuation and understanding of their inherited tribal institution, laws, language, and values (Kurian, 1987).

Traditional education provided individuals with the opportunity to acquire specialized skills as wood-carvers, tanners, blacksmiths, hunters, beekeepers, or medicine men. These skills were deemed by the society as difficult to learn, complex, but valuable to the society. Because of the sharp division of labour then, women were not taught these skills. The man was the nominal head of the home although the women engaged in the physical labour that sustained them. The major responsibility of women was childbearing for the extension of the family and the ethnic group. Women worked in the fields and provided food for their families. Although these skills were crucial and central to the survival of the patriarchal family and the ethnic group, they were not valued by the society in the same way as the "learned" skills that were taught to men. The transmission of women's skills from mother to daughter was taken for granted. Boys and girls were treated differently and they undertook different roles from early ages. The young boys and girls were taught according to their future roles as adult men and women. Women were treated as subordinate members of the family, clan and the ethnic group. The colonial models of education reinforced an already existing gender rift and capitalized on it.

The skills stated above were considered by the society as valuable for its survival, and men were designated as being capable of learning these skills. Indeed it appears that males were viewed as capable of performing valuable and difficult tasks in relation to the females' tasks, though all tasks were equally crucial for the survival of the society. Traditionally in Kenya, sons

have tended to be valued more than daughters. Even in these modern times, most monogamous marriages have turned out to be polygamous ones if the first wife has "failed" to bear a son. The birth of a son brings pride to the father and respect to the mother while a woman who does not bare a son is treated with contempt. A group attending a seminar on women's education in Kenya made the same observation.

> "Son preference" [in Kenya] can be observed right from the moment of birth. The birth of a male child is celebrated as a great event in the family and society at large but this is not the case in the birth of a girl. (Eshiwani, 1983, p. 88)

These attitudes seem to have filtered into the schools, where they influence the opportunities that are made available to boys and girls in schools.

The coming of the Europeans affected the entire fabric of traditional culture. It became evident that the African population of Kenya would be the main source of labor for the new ruling class. The settlers wanted a male, semi-skilled work force and they demanded that the Africans be given a form of education that would maintain and enhance their subordination to the white farmer. As a result, formal education developed along racial as well as gender lines. Academic education was provided for the Europeans, while industrial training was provided for the Africans. In the schools, alongside training in writing, reading and arithmetic, stress was on health and hygiene, agriculture and gardening, and home economics (Sheffield, 1973). At this early colonial time, the life of the African was changing drastically as conditions were created by the colonial government to force the men to seek paid employment. The introduction of the head tax by the colonial government was one such condition. Once the men took employment on the settlers' farms, women and girls had to assume the household and homestead work that the men had been doing, so the total work assigned to the household increased. This meant that girls could not get an opportunity to go to school that was equal to that of their male counterparts.

During this colonial time, Kenyans rejected vocational education and demanded an academic one, which they later gained by starting their own independent schools. Within this

situation, female representation was still low in schools even at the eve of independence in 1963. Since independence, Kenya has made remarkable progress in providing educational services to its people, yet significant disparities still exist between the sexes in access to educational services (Kenya Population and Development, 1980; Kurian, 1987). This legacy of under-representation of girls in education has continued into the present time.

Men had a head start in education during the colonial years, and the lead continues. Until recently, rural parents have been unwilling to invest in their daughters' education because they consider such investment wasteful or frivolous. Also, research has shown that on the whole girls show a lower return on education than boys; in terms of quantitative comparative data, Kenyan women are underrepresented in the formal labor market (Kenya Population and Development, 1980). This is not surprising, given that formal labor market activity and associated rewards (wages) are dependent on the level of education, type of education, or the individual's labor market experience, and on the prevailing economic and social conditions.

The remaining two sections of this chapter describe the two schools in which data were collected. The names of the schools have been changed to confirm that there is no intention to focus attention on particular schools or individuals. Some readers will recognize the schools from the descriptions, but they are urged to direct attention not to the schools but to the broad messages presented in the students' interviews. The location of these schools in Nairobi is acknowledged openly because Nairobi is a unique metropolitan centre within Kenya.

Kega High School

Ten female students from Kega High School volunteered to participate in this study. Kega High School is situated in the western part of Nairobi, in an area that was reserved for the whites during the colonial period. As you drive from the city centre towards Kega High School, the contrast between this area, westlands and eastlands becomes very distinct. In this area, there are magnificent houses with large compounds that are fenced. The gates of most of these

houses are patrolled by security personnel and most of the gates have the words "mbwa kali" written on them, to warn any trespasser that there is a fierce dog in that compound. The main road is about two kilometres from the school gate. The road that leads to the school has bumps to ensure that drivers do not exceed the maximum speed of 15 KPH that is allowed in the school compound.

The school has one main entrance which is patrolled by a security officer and on the gate are inscribed the words of the school motto: "Servire est regnare"—to serve is to rule. Any person coming into the school has to specify the purpose of the visit to the satisfaction of the security officer. If a visitor does not cooperate with the security officer, this officer calls the headmistress to alert her to the problem and to seek advice on the course of action to be taken. Young male visitors are treated with much suspicion because the security officer assumes that these young men, who might claim to be relatives of some girls, are just feigning and are actually boyfriends of some of the girls. Young male visitors are welcome only if they are in the school for educational purposes or any other official activity such as inter-school debates.

Kega High School is one of the magnificent monuments to the faith of the European community that it had come to Kenya to stay. No secondary school in Kenya could match its facilities and amenities. When the institution was officially completed in 1947, the Colonial Government had spent some 700,000 pounds sterling on its construction. The school is on 160 acres of lawn and woods, and its playing fields overlook the Kileleshwa Valley which is a few kilometres from the centre of Nairobi. The buildings of Kega High School are of a unique structure, 10 houses stretch in a semicircle around a five-acre plot; classrooms form their own quadrangle and beyond them stand eight science laboratories and a lecture theatre. Between the tuition and residence blocks are the dining hall, the library, the shop, and the administration block. The classrooms are in two rectangular structures separated by a two-acre spanse of lawn. On this lawn stands the "ark royal," a wooden classroom which is used as a study room by senior students who do not wish to study in the library. Also, on the lawn are trees that are trimmed and

provide perfect shade for the senior students after lunch and before the afternoon classes. The junior students are not allowed to walk on this lawn. The senior students and the prefects are the only ones permitted to walk on the lawn. All other students are punished and given conduct marks. Each negative mark penalizes the entire house to which the offender belongs, limiting its chances of becoming the overall best house of the year, or the "cock house." The house that becomes the cock house has a prestigious dinner party hosted for it. This tradition and many other traditions of a British public school are still evident after more than two decades of independence. At the southern end of the classrooms are the six boarding blocks which constitute 10 different houses. Until 1978 these houses had foreign names: Kirby, Mortimer, Nightingale, Beale, Huxley, Hamilton, Bronte, Mitchell, Curie and Baden Powell. After 1978, all the houses were given indigenous names except for Baden Powell house, named to honour the founder of the Boy Scouts. This name was not changed because Baden Powell died in Kenya and is buried there.

On the southwest end of the school is the swimming pool with changing rooms and showers close by. No student is allowed near the swimming pool in walking shoes or in the swimming pool without a life-saver. Near the swimming pool is the gymnasium which also houses the store for lawn tennis racquets and an office for the physical education teacher. Behind the gymnasium are 12 tennis courts, each of which is fenced with wire mesh. Between two courts there is a water tap. Adjacent to the tennis courts are eight hockey pitches spread out to the extreme west end of the school. Netball and basketball courts and the athletics field are near the hockey pitches.

Kega High School offers boarding facilities to all students who require them. However, there are a few students who prefer to be day scholars for health or dietary reasons. Those with dietary concerns are usually the students of Asian origin. A school bus picks up day scholars from the city centre if they are not brought to school by their parents. Girls in Kega High school wear white shirts, black and red striped ties, grey skirts and brown lace-up shoes. Each boarding

block has a housemistress who is in charge of the girls. These housemistresses make sure that no girl leaves the school compound without permission. This is made possible by taking roll calls before and after supper time. For this reason, Kega High School is nicknamed "boma," or prison. In the dining hall, the walls are covered with plaques commemorating the local and abroad universities which old girls have entered. The plaques date back to the late 1940's.

The school day begins at 8 a.m. and ends at 4p.m. with a 30-minute break at 10:30 a.m. when all the students go to the dining hall to have their tea. They also get a one-hour lunch break at 12:45 p.m., when lunch is served to all the students and teachers. The rest of the time is divided into nine 40-minute periods. All schools in Kenya follow the same curriculum, although there are some schools that offer more options because of their facilities. For example, because of lack of facilities and pesonnel, most schools do not offer music, French and German. Kega High School has been offering these subjects for over four decades.

Jogoo High School

Jogoo High School is situated in the eastern section of Nairobi. This area is referred to as the "eastlands," a colonial legacy of segregation. In the colonial days, the Africans could live only in the eastern part of the city, while the Europeans lived in the western part of the city. The houses that were built by the city council for the Africans were very small because the colonial government did not want the Africans to bring their families to the city. Often these houses had only one room. These "cubicles" were to accommodate just the employed African, and almost all employed Africans were male. Families of the Africans who were working in the city continued to live in the rural areas where the women took full responsibility for the household chores.

With the two decades of independence, Kenyans have seen much improvement in the living conditions for most city residents. The city commission and estate developers have been able to construct better houses in the "eastlands" neighbourhood. However, it has been difficult

for the city commission to cope with the demand for housing because of the continuing influx of people from the rural areas seeking jobs in the city.

The cost of living in Nairobi is very high. Monthly rents for the newer houses that were built after independence are not affordable to most city residents. The old houses constructed by the colonial government are still inhabited because the monthly rent for these houses is low compared to the rent for the newer units. Thus eastlands has become a haven for most Nairobi dwellers and, as a result, it is extremely crowded. Most of the people who live here are employed in government ministries or work as casuals in the nearby industrial area. The industrial effluents that pollute this environment explain why the Europeans did not want to live in this area.

Most of the students in Jogoo High School live in this area or the surrounding areas. The school does not have boarding facilities and therefore all the students live with their parents, relatives or guardians. The students walk to the school, take a bus, or ride one of the mini-buses commonly known as "matatus." The matatu personnel, the driver and the tout are usually young people who have either dropped out of high school or did not perform well enough in their national examinations to qualify for entry into other formal sectors of the economy. The tout is usually carried hanging out of the matatu, yelling at would-be passengers and hurrying them into the matatu while it is still moving slowly. As a passenger boards the matatu, the driver drives off speedily jerking the passengers back and forth in the matatu. The matatu drivers rarely obey traffic rules, such as stopping at the designated bus stops; and they will stop anywhere else usually abruptly, if they suspect that a person walking towards a bus stop would like to board the matatu. Such is the transport the Jogoo High School students have to use every morning and evening. The students travel to and from school during the peak travel hours, when the buses and matatus are so full that people stand at the door-steps. It is not surprising to see the students standing on the first step of the door of the matatu or bus with their school bags on their backs protruding even further.

On the way to Jogoo High School one passes through the Jogoo estate and Hamsa estate. The latter is composed of rows of single-roomed houses with a tiny bathroom/toilet adjacent to the entrance door. These houses have one small wooden window with a wooden handle that opens like a car's bonnet. The water tap is situated outside the house, and it usually runs dry because of the frequent bursts of the major water pipe to the eastlands. Jogoo estate units are more modern and larger in comparison to the Hamsa estate units. These are one-bedroomed apartments with a larger sitting room, a portion of which is converted into a bedroom by most families. These houses have piped water in the small kitchen and the bathroom/toilet.

In the vicinity of the school, there is a small open air market where people sell all types of merchandise including roasted maize. The school borders the main road and has a wire-mesh fencing that is reinforced by a thorn hedge. A sign board at one corner of the fence bears the name of the school, its address and telephone number. The gate is quite narrow and is rarely patrolled by a security officer.

The first three buildings in the school compound near the gate are occupied by non-teaching staff. After these are two other houses and a block of four apartments occupied by members of the teaching staff. The deputy headmistress lives in one of them but the headmaster lives outside the school. The whole school compound is about 15 acres, half of which is taken up by the athletics field. The school design is similar to an equilateral triangle. The junior classrooms form one side of the triangle, senior classrooms and the three laboratories form the second side, and the third side is the administration block and library. The walls of the buildings appear to be low and have windows fitted with wire mesh. Outside each classroom are lockers used by the students to keep their books and physical education kits. The administration block includes the staffroom and offices for the headmaster, deputy headmistress, and school secretary. Outside this block is an elevated ground that forms a circular platform with several stair-cases. On the platform is a post for the national flag which is raised every Friday morning. On Monday and Friday the whole school assembles here in the morning and the headmaster

addresses the school, as does any other teacher who wishes to announce anything of interest to the whole school. Behind the platform there is a small area that is allocated as the parking area for the staff and visitors. Next is the fence which separates the school from the neighbouring estate. When you are in the school compound and in the classrooms, you can hear children in the estate laughing and crying, their mothers or maids screaming at them, and dogs barking. These noises are loud and disturb the students especially during science lessons because the laboratories are nearest to the fence. During the data collection, much of this noise was recorded since the interviews were conducted in the laboratory. On the other side of the school is the main road which is also extremely noisy because of the large number of commuter vehicles that frequent this area.

Students wear uniforms consisting of a grey skirt and white shirt for girls and grey shorts or trousers and white shirt for boys. The school day begins at 8 a.m. and ends at 4 p.m. with a 30-minute break at 10:30 a.m. The students do not take anything for break. During the lunch break, most of the students go home or buy a piece of roasted maize or cake from vendors near the school compound. The rest of the time is divided into nine 40-minute periods.

Although all schools maintained by the Kenya government are supposed to follow the same curriculum, the options are limited by the facilities available in the school. Jogoo High School offers industrial education, which is not offered in many other schools. The picture that one forms of Jogoo High School is that of a school established to produce workers rather than leaders in the society.

The two schools described above were chosen from a wide selection of schools within Nairobi. Kega High School and Jogoo High School represent differences in class that ultimately have some influence on the students' perceptions of science. Historically Kega High School was established during the colonial period for the European girls. Therefore, the role of this school was to produce leaders in the society. Since independence in 1963, this school has continued to provide education mostly for the children of Kenya's elite. On the other hand, Jogoo High

School was established to produce workers in the society. This school draws its student population from the low socio-economic neighbourhood which surrounds it.

It is evident that the socio-economic status of a school and of a student could influence the aspirations of the student in terms of career choices. From personal experience, students of low socio-economic status lack the resources and the "contacts" required to pursue the most ambitious of careers. However, Sue Lees (1986) observed that what happens to girls in the school and in society is determined as much by the very fact of being girls and as by their being working class or academically successful (p. 134).

CHAPTER 3

LITERATURE REVIEW ON GENDER AND SCIENCE

There is a significant and rapidly growing literature concerning gender and views of science. In developing a rationale for this study of female Kenyan students' views of science, it is useful to examine the available literature in terms of the following categories: conflicts between science careers and femininity, achievement and attitudes, selection of science subjects for study, possible reasons for females not choosing science, students' views of science, and career choices. The literature on gender and views of science shows that girls are primarily seen as potential wives and mothers and their choice of subjects in high school still tends to reflect traditional sex roles. Also, studies have shown that girls are afraid of pursuing careers that are considered "unfeminine," that might not only be incompatible with motherhood but might make them face discrimination when they enter the labour market.

Conflicts Between Science Careers and the Social Construction of Femininity

Pippa Brewster (1980) noted that young girls arrive at primary school with strong motivation to succeed. However, at secondary level, these competitive little girls learn to become non-competitive young women. During this adolescent period when the girls' adult roles are being developed, the dividends of femininity can appear to be much greater than those of "the career woman." It is likely that the message of maternal fulfilment appear much more seductive than that of loneliness associated with career women and therefore, many young girls are lured by one and frightened by the other. When girls opt out of education and choose careers that will enable them to become wives and mothers, they are making a sensible choice in terms of social rewards and punishments. Brewster (1980) noted the following:

> It is often far more threatening to be unfeminine than it is to be an underachiever. . . .there is no contradiction for men between masculinity and achievement. The masculine man is one who achieves, who is masterful; the feminine woman is one who underachieves, who defers. (p. 11)

Sue Lees (1986) noted that individual experience is socially constructed and many of our experiences are caught up with ideas and definitions of femininity and masculinity that are constrained by these social definitions. It is regarded as natural for girls to enjoy domesticity, to get married and have children but unnatural to want a career that would conflict with marriage. Therefore, girls are seen primarily as potential wives and mothers rather than salaried workers. Consequently, the understanding that there is another job for a woman besides paid work is never lost sight of by girls and stands in sharp contrast to career considerations.

During the nineteenth century, education systems were structured as much by gender as by class. Girls were educated either for domesticity or to be "cultured wives." Lees (1986) observed that gender inequalities have not been seen by most policy makers as impediments to the equality of opportunity. For example, as late as 1963 an education system committed to formal equality was seen as a weakness from the standpoint of educating girls:

> We try to educate girls into becoming imitation men and as a result we are wasting and frustrating their qualities of womanhood at great expense to the community . . . in addition to their needs as individuals, our girls should be educated in terms of their main social function which is to make for themselves, their children and their husbands a secure comfortable home and to be mothers. (p. 118)

Girls are no longer being openly educated for domesticity. However, the sexism of the educational system is still, to a considerable extent, reflected in the workings of the formal structures of the school. The social process, the formation of attitudes and cultural values, the formation of groups and identities takes place as part of school life. The pressures towards marriage and the strong pull on girls towards domesticity regardless of their class membership

are daily enacted in the social and family life of adolescents and they are also powerfully reflected in the social life of the school. Sexism is obvious in the social life of the school, in the presence of and interaction with boys and in the behaviour of teachers since the social boundaries of the school as a social system are not rigidly defined (Lees, 1986 p. 119).

Equality of opportunity for the sexes has not in practice been easy to achieve. The choice of subjects still tends to reflect traditional sex roles with fewer girls in science courses. Female students who participated in a study by Lees (1986) noted that a job is one thing but a top career for a woman is threatening to a man. The girls noted that to pursue certain careers "you have to be very special." Being "very special" meant being able to overcome not only the pressures towards domesticity and marriage that make themselves felt even among academically oriented girls after the age of 16, but, for those girls who do aspire to a "top career," the discrimination that they will face when they enter the labour market. Equality of opportunity for sexes seems hard to achieve since most teachers tend to agree with equal opportunity policies in principle without realizing what they mean in practice. For example, some teachers say that schools have to prepare pupils for work in society as it is—a gender segregated society.

Evelyn Fox Keller (1985) observed that the objective sciences have been given a strongly masculine image and, as a result, the identification between scientific thought and masculinity has become deeply embedded in the culture at large. Sciences are described by our society as "hard" as opposed to the more subjective branches of knowledge. According to Keller (1985), by describing sciences as hard and other subjects as soft, a sexual metaphor is implicitly invoked, in which "hard" is of course masculine and "soft" is feminine. Thus a woman thinking scientifically or objectively is, it is suggested, thinking "like a man." It has been found that most girls in secondary schools are frightened by mathematics and science. According to Lees (1986) this is because, science and mathematics subjects are taken as paradigms of truth and the advance of knowledge and they are quintessentially "male" subjects taught from the standpoint

of the domination and the control of nature. Therefore, girls tend to choose subjects that embody female role models and to pursue careers that are traditionally pursued by women.

Achievement and Attitudes

Research in the U.S, the U.K, and elsewhere has consistently shown that, in general, girls are not seen to achieve as well in science classes as do boys. Between ages 9 and 14, girls' science achievement seem to decline and their interest in science wanes (National Association of Educational Progress, 1978; Hardin & Dede, 1978; Johnson, 1987). At high school, boys score higher in sciences than girls (Kahle, 1985). Attitudes toward science have been found to be significantly related to achievement. Female students tend to hold less positive attitudes toward mathematics and science as compared to their male counterparts (Fennema, 1985; Sherman, 1982). Kelly's (1981) study of science attitudes and achievement showed that pupils with favorable attitudes toward science tended to achieve better in science than pupils with less favorable attitudes. However, it has also been noted that girls are not underachieving in science at school. The idea that they are less able scientists or technologists is based more on their past absence from these areas than on any real estimate of their potential (Blackstone, 1985).

Selection of Science Subjects

Research has further shown that during high school girls do not elect to take science and mathematics as often as their male counterparts (Dearman & Plisko, 1981; NSF, 1982). In the university, fewer girls choose science, especially the physical sciences, as their major area of study. However, the percentage of women choosing social sciences and education as their major is over twice that of men in those fields (Butler & Marzone, 1980). Johnson & John (1987) investigated the option systems within science at ages 13 and above in Britain. The results showed there is an imbalance in science education; the polarization of boys and girls into the physical sciences and biological sciences respectively was a particular manifestation of this.

Possible Reasons for not Choosing Science Subjects

Khoury (1984) found attitudes toward science, belief in the usefulness of science, general achievement, and teacher support to be important factors influencing female course plans. Keller (1974, 1985) argues that the linkage in the ideology of modern science objectivity (a cognitive trait), autonomy (an affective trait), and masculinity (a gender trait), derives from the asymmetries of child care. She argues that it is precisely this male mind set that has been written into the norms and methods of modern science. Easlea (1986) also argues that science and physics especially is given a strongly masculine image. Traweek (1984), an anthropologist, reports that the predominant traits manifested by European and American members of the International High-Energy Physics Association (of which 3% are women) are predominantly defined by our society as masculine.

Research has also shown that girls and boys are still taking different subjects and even when they have the option to take subjects formerly associated with their opposite sex, they are often either actively encouraged to make traditional choices by their teachers and parents, or their own preferences are for subject areas traditionally associated with their sex (Sarah, 1980). The traditional role pattern for men and women in society resulting in different socialization experiences for boys and girls from infancy tend to influence students especially when they choose careers (Johnson, 1987). When it comes to choosing an "appropriate" career, even when sexual divisions between subjects are eliminated, gender identities and sex-role expectations, already well formed, influence the way in which pupils interpret what they are doing (Sarah, 1980). According to Jane Gaskell (1987), schools create differences among students by enrolling them in different courses. Teachers limit the available choices, shape the way students see themselves and their options, and offer advice, veiled threats, encouragement and strongly worded suggestions (p. 152). Gaskell's study showed that girls continued to choose very traditional paths through school, paths that reproduced both class and gender categories. Gaskell concluded that:

> These girls knew, for their own good reasons, what the world was like, and their experience acted as a filter through which any new message was tested, confirmed, rejected, challenged, and reinterpreted. Changing their minds would have meant changing the world they experienced, not simply convincing them of a new set of ideals around equality of opportunity and the desirability of a different world. (p. 168)

Studies of Students' Views of Science

Various studies on students' views of science have shown that most students hold certain views which are not accurate and could affect their participation in science and science related careers. For example, Weinreich-Haste (1978) collected statements from 14-year-olds on the image of science, the science teacher, and the activities of scientist. The statements reflected an inaccurate and limited picture of the activities of science and scientist. The students stated that a scientist was a man engaged in boring, repetitive and unrewarding work, out of touch with people and human relations, and whose intellect dominated all aspects of his life. Yet these adolescents had made a choice, which may have been central to their future careers, between "science" and "arts." Kelly (1981) investigated pupils' views of science education. Most of the expressions were negative and some of the girls claimed that their physics teacher (who was a male) was overtly sexist in the ways he taught. The girls noted that the boys dominated the physics class and, they also teased the girls by referring to them as sex symbols. The teacher did not help to change the situation. Instead, he joined in these sexist conversations, and this embarrassed the girls and undermined their confidence. Theresa George (1987) investigated a female teenager's view of science and concluded that the teenager held the stereotyped image of a scientist as that of a man.

Career Choices

Marsha (1985) states that there are factors that affect entrance to and retention in scientific careers. High school math courses are said to serve as a "filter" in that students who do not take these courses find it much more difficult, if not impossible, to enter science and applied science programs (Sells, 1980). Vockell and Loblonc (1981) found that most high school girls rate science careers as masculine, especially the physical science careers.

Careers such as medicine have proved to be highly attractive to women. Law is becoming a centre of attraction for female students. It is unclear whether subjects with a bias towards human interests and concern for others attract girls through their intrinsic qualities or through social pressures that have conditioned females to think that these studies are appropriate for them. Occupations such as teaching and nursing are female domains world wide. One wonders whether females are attracted to them because of the professions' intrinsic characteristics or because they consider them feminine (Sutherland, 1987). The above assumption is plausible because socially, women are associated with a "warmth-expressiveness" cluster of attributes such as gentleness, quietness, tenderness, emotionality, passivity, dependence, and subjectivity (Broverman, Vogel, & Clarkson, 1972). According to Danylewycz, Light, and Prentice, (1986) women viewed teaching as a mothering role in the school or as preparation for mothering.

Increasing opportunities for women, and avoiding the reduction of options implicit in the rejection of, or failure at, science is a goal of many feminists (Keller, 1985a). Girls who cannot or will not learn science are cut off at an early age from a wide range of careers and interests. By conforming to a feminine stereotype that excludes science they are channelled towards traditional women's occupations. Girls who succeed in science have more choices than those who fail, and thus it is important to reduce the failure rate for females.

There is very little research available concerning these issues in the context of secondary and university science subjects being studied in Kenya. Nonetheless, available research has shown that the proportion of women in Kenya who have studied science to any appreciable level

is insignificant (Eshiwani, 1988, p. 9). In 1983 Eshiwani found that less than 28 percent of girls enrolled in the secondary school studied any science beyond Form II. Consequently, the number of women who went to the university to study science and science-related careers was very small compared to their male counterparts. It has also been shown that the very poor performance of girls in science subjects and in mathematics has been continual for the past ten years (Kagia, 1983). Eshiwani (1983) noted that there has been disproportionate accessibility to the study of sciences at secondary and upper secondary levels between boys and girls in Kenya. He observed that:

> Whereas the number of arts streams for boys and girls have been nearly equal over the past few years, the proportion of science streams has been heavily skewed towards boys, there are about five science streams for boys to one science for girls. (Eshiwani, 1983, p. 42)

It has also been noted that there are no strong science programmes in most girls secondary schools, and in most unaided (non-government) schools where enrollment of girls is quite high, no science programmes are offered (Eshiwani, 1983). The re-structuring of the education system (from 7-4-2-3, to 8-4-4) requires all students to take science subjects, but there are no funds to bring science teaching facilities up to a common standard. This gives an advantage to students at boys schools and a few girls schools, such as Kega High School, where adequate facilities already exist for effective teaching of science.

Most of the studies cited above have been done in developed countries and in different contexts from that of Kenyan society. Quantitative research methods have been used to collect data for most of the studies. The instruments used for the data collection do not allow interactions between the researcher and the respondent so as to elicit reasons that might explain some of the observations. However, the few studies on women's representation in science and science-related careers in Kenya indicate that there is a significant problem, in terms of attitudes, achievement, and course selection by females in science. Thus it seemed most appropriate to

study this issue in Kenya by investigating female students' views of science, to determine how these views take on personal significance and influence their achievement and course selection. The probable bases of these views were also explored. In the Kenyan context, this exploration was in keeping with the current government policy of encouraging women to compete at an equal level with men for job opportunities in science-based careers (Kenya Ministry of Education, 1984).

CHAPTER 4

METHOD OF DATA COLLECTION AND ANALYSIS

Introduction

This chapter describes the participants and the strategies that were used to collect data for this study. The data analysis strategies are also discussed. Twenty students participated in the study, 16 female and 4 male students. The study focused on female students in an attempt to identify some of the factors that lead to girls' exclusion from science. Qualitative research methods were used to collect detailed accounts of the students' views of science. The major data collection strategy was the nonscheduled standard interview. Data were analyzed and categories developed that seemed to best present the complex whole of the students' views of science.

Twenty students were interviewed from two high schools, a girls-only school (Kega) and a co-educational school (Jogoo) situated in different socio-economic neighbourhoods of Nairobi. The participants were selected on the basis of their gender and level of secondary education. Students studying pure science courses at the third year of secondary education were selected to participate in this study. These students were the most appropriate participants because by the third year of secondary education, students have experienced several years of formal science teaching and are able to discuss in some detail their experiences of science education. Also, students at this level are expected to be considering the careers to pursue after high school. Six female participants came from the co-educational school. These were the only female students in the pure science class and the only ones who as a result have the opportunity to pursue science careers in university. The other 10 female students who volunteered to participate in this study were from the single-sex school, where there were more girls studying pure science.

The study focuses on the female students' views of science because this is the only way we can begin to understand the female students' "world" from their own perspective. This can provide a better understanding of the factors that lead to girls' under-achievement in science in high school and the observed under-representation of females in science and science-related careers in Kenya. This can also help educators transcend the established pattern of blaming girls for the poor performance in science by making transparent the latent factors that contribute to the observed girls' apathy towards science. Smith (1987) noted that:

> The everyday world is neither transparent or obvious. . . the everyday world where people are located as they live, located bodily and in that organization of their known world as one that begins from their own location in it, is generated in its variety by an organization of social relations that originate elsewhere. (p. 91)

An inquiry that focuses on female students' view of science yields an account of the girls' own experiences of everyday relations, both in school and outside school, that shape their opportunities as well as their constraints. The everyday world is taken to be various and differentiated matrices of experience—the place from within which the consciousness of the knower begins, the location of her null point (Smith, 1987, p. 88).

The first interview took place on May 30th, 1989 at Jogoo High School, when two students were interviewed. The interviews were preceded by observations of two 40-minute chemistry lessons. These lessons were held in the laboratory. The first period was used to discuss observations of and questions on the previous practical or lab. During the second period, the students were given a practical to do.

After the observations, with the chemistry teacher, ten students were selected to participate in the study during a spare period in school hours or after classes during games time. Permission for the students to participate in the study was granted by the headmaster. Each participant from Jogoo High School was interviewed twice while those from Kega High School were interviewed only once.

Initially, I had anticipated collecting data from a co-educational school only. However, during the data collection process at Jogoo High School, I decided to broaden the research perspective by involving female students from a single-sex school with a socio-economic background different from that of Jogoo High School. This possibility was suggested by recent research findings by Eva Rathgeber (personal communication, March, 1989) of the International Development Research Centre showing that most female physicians in Kenya went to a specific girls-only high school. Thus I decided to go to Kega High School, where I had been a student for my six years of high school. The first interview at Kega High School took place in June of 1989. Soon after the first interview with each of the participants at Kega High School, the students became very busy preparing for the joint "mock" examinations and other end-of-term activities. The joint examinations are similar to the national examinations and are used to predict a student's performance in the national examinations as well as to prepare them for it. It became impossible to schedule a second interview with these participants.

Each interview in both schools was based on matters relating to the participants' present course, and future career aspirations and their experiences in school, at home, and in their peer group community. The following topics were found to be useful in the interview.

1. Science: The discussion covered various aspects of school science including the students' views of school science and their experiences in science.
2. Science as a career: The discussion explored students' understanding of careers, what they consider to be viable careers, and their views on science as a viable career.
3. Scientists: The discussion explored what the students considered to be the activities and characteristics of a scientist, and who can be a scientist.
4. Future plans: The students were asked about the possibility of having a family in the future and what role they expected to play in the family.

Qualitative research methods were used to collect detailed accounts of the students' views of science. The major data collection strategy was the nonscheduled standard interview. In this type of interview, there is flexibility in question order, which allows the interviewer and the participant to be more natural and responsive (Goetz & LeCompte, 1984). This method of data collection also allows flexibility for effective probing, which enhances explanations, clarification and completion of detail (Patton, 1980). In addition, this interview method facilitates in establishing rapport and makes the inquiry one in which the subjects of inquiry are not treated as objects of study but as knowers (Smith, 1987). The consistencies and contradictions between the students' social and cultural realities and their understanding of these realities are revealed by such an approach.

Although the establishment of a non-hierarchical relationship between the interviewer and the respondent is the ideal goal for this methodology, I found that as interviewer my status as an adult and former science teacher had some effects on the participants' perception of me, especially at Jogoo High School. During the first section of the first interview at Jogoo High School, the students were quite reserved and gave brief responses. However, I was able to break down these social hierarchies by sharing with the students my own experiences as a female student in high school and in university. This reciprocity helped in creating an atmosphere in which the participants were free to express themselves and to give the frame of reference within which their feelings and beliefs take on personal significance.

Tape recording was the primary means of collecting information for the study. Thirty interviews were recorded between May and August, 1989. Permission to record the interview conversations was obtained from each student. I gave them the assurance that their identities would not be disclosed in any way. The participant observation and construction of field notes enriched data for the study, especially in that I was able to get a picture of two science classroom activities. Field notes were taken to record impressions expressed non-verbally in the interviews. Each participant at Jogoo High School was interviewed twice, with a second interview serving to

obtain further detail on themes and issues expressed in the first interview. Each interview lasted about 45 minutes. The interview questions were carefully worded so as to make their meaning clear to the interviewee.

Most of the tapes containing the first interviews were transcribed immediately after each interview, when it was easier to remember most of the discussions and to complete portions of tapes that were inaudible. Also, I was able to discover that I had not recorded one interview due to a technical factor and was able to arrange for another interview session with that student.

Data Analysis

Several strategies were used in order to make sense of data collected. The strategies employed were those that seemed to permit the presentation of data in categories that could best present Kenyan students' views of science. I began the search for patterns and regularities in the students' views of science during the data collection period when I was transcribing some of the tape recordings of the interviews. Taylor and Bogdan (1984) point out that data analysis has to be an on-going process in qualitative research, so that data collection and analysis are linked. Goetz and LeCompte (1984) also recommend that researchers analyze data throughout the study rather than relegating analysis to a period following data collection (p. 165). During data collection and analysis, I regularly reviewed the initial research proposal.

I began a more comprehensive data analysis process after most of the interviews were transcribed. I scanned through the data, jotting notes and observations as the reading progressed. The notes that I took during the scanning constituted the beginning stages of organizing, abstracting, integrating and synthesizing data on Kenya students' views of science. Patterns, regularities and contradictions generated from the recorded interviews, lesson observations and field notes were transformed into categories by the process of comparing, contrasting, aggregating and ordering of data. The categories that seemed to best present the complex whole of the students' views of science were "school experiences of science

education," "images of science," "science as a career option," and "family, paid work and partners." The following chapter presents data collected for this study.

CHAPTER 5

PRESENTATION OF DATA

This chapter presents data from the interviews on students' views of science. The data are presented in four categories: students' experience of school science education, images of science, science as a career option, and family, paid work and partners. Firstly, data on students' experience of school science education are presented. In this section, female students' experience of science education appear to be influenced by the type of the school. This section is followed by data on the students' images of science. These are images of the usefulness of science education in high school followed by students' views of scientists and their activities and of women as scientists. Data on the students' images of science show views that are related to gender and type of school. Third, data on students' career anticipations are presented under the category science as a career option. The last section presents data on students' views of family and the importance of paid work. Data show that 19 of the 20 students interviewed planned to have a family. All the male students expect to be the primary supporters of the family and therefore a career is very important to them and something that must not be interrupted by family plans. Female students, especially those who were aspiring to higher education and careers in science-related fields, consider career development very important to them. However, they anticipate having a family and being primarily in charge of domestic labour, reconciling them to a double life of a career and motherhood. Balancing these two socially incompatible roles is viewed as a struggle by the female students aspiring for science and science-related careers.

Students' Experiences of School Science Education

The data illustrate two important conclusions about students' personal experiences of science. At Jogoo High, girls tend to have negative experiences and doubt their capacity to do

science, while the boys feel that they can succeed in science. Then, in contrast to the girls at Jogoo, the students at Kega High show that they believe they have the ability to do science, and their experiences of science tend to be positive.

Female students at Jogoo High School

Atieno, a female student from Jogoo High, stated that most girls believe that they cannot manage science. According to this student, the impression that it is not possible for most girls to pass in science is conveyed to other girls studying science or considering taking pure science subjects by "victims" who have failed their examinations in science subjects. Also, the examination results in which most boys pass well in the sciences and most girls do not are interpreted by students as proof that girls cannot manage the science subjects. (In this study, MN is used to denote the speeches of the researcher and the uppercase italicized names denote the speeches of the male students).

> MN: I am interested in female students views of science and what experiences girls have of science education. May be for a start you can tell me something about yourself and your experiences of science.
>
> ATIENO: It is something we've really discussed with our friends, actually the picture that girls have taken about sciences is that they can't manage it, according to us when I was coming to form one, my sisters used to say that science is a difficult subject meant for boys only. When I came I got that picture of maybe I couldn't manage it. . . . It is something that has always been there they get the information from other people who have already done it, it is what we learn from others.
>
> MN: Others like who?
>
> ATIENO: Our friends who have already done the work, they find it very difficult for girls, so they try to persuade the younger ones that science is very hard or difficult,

don't try it and don't choose it for a career. In other words, try to avoid it. (Interview 1, May 30, 1989)

Atieno felt that the belief that science subjects are hard particularly for girls is evident due to their very poor final examination results in science. It is a fact that most girls at Jogoo High do not perform well in their examinations in science subjects. It appears that the students, and mostly female students have learnt to associate science with being unsuccessful and this belief seems to be the reality for most of the girls who consider science subjects during high school. The government's policy to make science compulsory did not propose methods that teachers could apply to give support to students and female students in particular, and that help them begin to see sciences as subjects that can be done by all students. It is evident that the past experiences most girls have had with science apparently appear to influence other girls' decisions when they are selecting science courses in high school. Hence, pursuing science courses in high school is likely to be seen by most girls in schools like Jogoo High as leading to the same unsuccessful ending.

ATIENO: Mostly girls do not make it if they take sciences.

MN: Why do you think it is the girls, where do they get this information from?

ATIENO: Maybe from the results the others get, examination results in which most boys pass well and most girls do not pass as well, this tends to make the girls feel that the men are just tough, tougher than the girls.

MN: Do you think that science is also tough?

ATIENO: Yes it [science] is also tough, but then they tend to take it as if girls cannot make it, those who've tried have failed. (Interview 1, May 30, 1989)

As a result of the understanding that science subjects are hard or "tough," Njeri, a female student noted that she would not have opted for pure science if she had not been selected by her teacher. She said that the information girls get regarding science subjects suggests that

these subjects are hard. She implies that she finds them difficult but not unmanageable. She prefers physics to chemistry.

MN: What then would you have chosen?

NJERI: I would have chosen to take Physical Science.

MN: Why?

NJERI: Because I tend to believe that pure sciences are hard.

Although she noted that science subjects were not unmanageable, she does not feel confident to study science beyond high school.

MN: So, do you feel that you will not be able to pursue a career in science?

NJERI: I do not feel that I can cope with science.

MN: Why do you feel that you cannot cope with science?

NJERI: I just believe that I cannot cope with science but I do not know why.

(Interview 1, May 30, 1989)

While Njeri notes that there are both boys and girls who find science easy, she believes that there are more boys who find science easier than girls. The reason she gives is that boys feel that they are the ones to tackle the hard tasks such as science. Here we see that the common Kenyan belief that hard tasks, such as clearing land for cultivation, are for males interacts with the general sense that sciences are hard to succeed in, resulting in a message that sciences are for males to study in school.

MN: Do you think that there are boys and girls who find science easy?

NJERI: There are more boys than girls who find science easy.

MN: What makes you think that there are more boys than girls who find science easy?

NJERI: You know the women, they just tend to believe that the sciences are hard to them but men feel that they can tackle it. Women believe that they have weak

brains to carry a lot of things and the men have a bigger capacity. (Interview 1, June 6, 1989)

The statement "men have a bigger brain capacity," suggest the belief that men are intellectually superior to women.

Nduku, a female student from Jogoo High, noted that there are topics in physics that boys find easier to understand than girls.

MN: How do you think it could be made easier for you to understand these many formulae in physics?

NDUKU: By cramming and by trying to understand it and know how to use it or when to apply but also some of the things we do like in Physics are hard to grasp and hard to imagine how they look like.

MN: Like what?

NDUKU: For us girls, things like motor vehicles, for example the accelerator, the engine parts, and many other things. You find that the boys discuss this with the teachers easily, but for us girls who do not take interest in such things, we tend to think that they are men's work. (Interview 2, May 31,1989)

This could be one of the many times when girls are excluded from science activities especially during physics.

Mbithe, another female student from Jogoo High, stated that she finds science subject very difficult to understand compared to the other school subjects. The student seemed to believe firmly that she cannot do well in sciences and appeared to have succeeded in preventing herself from doing whatever she may recognize as science. The student stated that her performance in science was very poor.

MBITHE: They [science subjects] are very difficult to understand. I usually get very low marks in the tests we are given. (Interview 2, June 16, 1989)

As Papert (1980) notes, "the consequences of such self-sabotage is personal failure, and each failure reinforces the original belief. And such beliefs may be most insidious when held not only by individuals, but by our entire culture" (p. 42). Deeply rooted beliefs about their inability to understand science appear to restrict these girls' success in science subjects at school and their willingness to consider a scientific or science-oriented career.

Here deficiency seems to become identity, and the self-perception of deficiency is very disarming. One begins to see the school as an organ that works against those whom it is intended to serve, particularly when one considers that children begin their lives as eager and competent learners. It appears to be an unintended consequence of schooling that they develop trouble with learning in general and with mathematics and science in particular. School experiences of science and mathematics appear to occur in such a way that students will attribute their unsuccessful or unpleasant learning experiences to their own inabilities.

Male students at Jogoo High School

In contrast to the females at Jogoo High, male students find science subjects interesting, applicable to everyday life, and much easier than other school subjects. These students also know that university admission is easier with passes in science.

MN: Is there any other reason why you took the pure sciences?

MUTUA: I find the pure sciences also much easier.

MUTUA: Yes, physics is easy, you know with physics, a lot of maths is applied and I like maths very much.

MN: Therefore you like physics because physics has a lot of maths?

MUTUA: Yes, I also find physics applicable to everyday life.

MUTUA: As for the academic purposes, it is very easy for one to get into the university with sciences. (Interview 1, May 30, 1989)

WEKESA: They [science subjects] are interesting, you find a lot and you discover a lot of things you didn't know. (Interview 2, June 26, 1989)

However, a male student who is not anticipating a science-related career noted that he finds physics and chemistry very complicated but still likes them.

MUTHOKA: Physics, chemistry and maths I feel need more time to study because they are more complicated than any other subject. (Interview 1, June 8, 1989)

Female students at Kega High School

Students in Kega High School, where all students are female, report very different experiences of and attitudes toward science subjects than their counterparts at Jogoo High School. Students hold positive attitudes toward science and math, and science careers. Besides seeing science subjects as interesting, they also see the options that they keep open by taking them. The following statements show students' positive inclinations to do science and to consider science oriented careers.

MN: What can you say about the subjects you are taking?

ADHIAMBO: I enjoy them, especially the science subjects.

MN: What about them do you enjoy?

ADHIAMBO: I like sciences because they bring up the facts of nature, they do not beat around the bush. . . they also help me understand more about God's creation. . . the wonders that naturally I cannot understand, they also give concrete prove to every day events.

ADHIAMBO: I would also like to pursue a related career in sciences, engineering. (Interview, June 26, 1989)

WAMBUI: My best subjects are maths, geography and chemistry. (Interview, June 27, 1989)

MN: Why do you think it is better to take pure science?

MUMBI: First of all it is more interesting in that you do more practicals and things like that and I think at the university, they choose people who have a deeper knowledge of sciences. (Interview, June 26, 1989)

It is not surprising that female students in Kega High have positive experiences about school and science in particular. Research has shown that female students in single-sex schools receive more attention than those in mixed-sex schools (Lees, 1986). Girls in Kega High are more likely to receive more encouragement to do well academically, while in Jogoo High it appears that it is harder for the girls to view their futures in academic terms in the face of and in the presence of boys.

Experiences with mathematics at both schools

Most of the students interviewed portrayed positive attitudes towards mathematics. Students from Kega High School noted that their ability to do mathematics is an advantage to them. Being able to do mathematics enables them to do well in other subjects such as chemistry and physics that require mathematics skills.

MN: How are you preparing for this challenging career?

MUMBI: I concentrate a lot in maths and in fact it is my best subject. It is one subject that I am interested in. (Interview, June 26, 1989)

MN: What can you say about the subjects you are taking?

MUENI: I like maths best then physics and chem.

MUENI: I like it because there is reasoning that's why I like math so much. . . unlike in history where you have to memorize but in maths there is logic. (Interview, June 29, 1989)

MUTUA: Physics is easy, you know with physics, a lot of maths is applied and I like maths very much. (Interview 1, May 30, 1989)

Although most of the girls who were interviewed seemed to have the ability to perform well in math, generally girls' performance in the national examinations in science and mathematics has been very poor compared to that of boys (Kenya Ministry of Education Science and Technology, 1989). The only subjects in which girls perform better than boys are Literature in English and Christian Religious Education.

Classroom practices observed and reported at Jogoo High School

Girls reported that they were exposed to some classroom practices that were very discouraging. They stated that boys try to challenge them by mounting high competition, especially when girls taking science performed better than the boys. Although the challenge was directed particularly to the girl who out-performed boys in science, the challenge was said to be so intense that most girls gave in. One female student noted:

> ATIENO: The boys try to challenge the girls and the girls feel that they cannot manage. . .
>
> MN: The boys challenge the girls who are studying science?
>
> ATIENO: Yes, they challenge us so much.
>
> MN: How do they challenge you, or in which way?
>
> ATIENO: In case a girl tries to do well in pure science boys who are not doing well ask themselves "how can this girl defeat me," they do not like defeat. So they come and challenge, so with all other challenges, the girls just give up.
>
> ATIENO: The boys try to give a tough challenge.
>
> MN: How do they do it?
>
> ATIENO: They [boys] work even harder than the girls and when the girls see that they are being defeated, they just give up. (Interview 1, May 30, 1989)

One possible form of challenge observed by the researcher was the role boys and girls played during labs. Due to inadequate apparatus, students did practicals or labs in groups of six.

All the six girls were in three different groups. These girls did not do the labs, instead they recorded the observations as instructed by the boys who did the labs. Some male students claimed that "volunteering" to do the labs for the girls was one way of encouraging them to do science. It was evident that the girls were denied opportunity to do the labs and gain confidence in making deductions and understanding science concepts better, which most girls felt was the essence of doing labs.

WACHERA: When you do something practically, you see how things really happen.

MN: Do you feel that the experiments are part of the detail which you get from doing pure sciences?

WACHERA: Yes. You tend to understand better when you see the experiments work. (Interview 1, May 31, 1989)

Some boys alleged that girls were afraid and that it was this fear that caused the girls not to volunteer to do the labs.

MN: Does that mean that the girls do not like doing experiments?

WEKESA: They are afraid and they never want to volunteer to do them. With us Africans, men are the ones who do things and ladies come afterwards and maybe that's why they behave like that in classes and they fear to do things such that the boys are the ones who volunteer to do things.

WEKESA: They usually sit there and record the results of the experiments and they hardly do the experiments themselves. (Interview 2, June 23, 1989)

The above statements suggest that girls hardly participate in science lab classes. The repercussions being that girls waste almost half of the time allocated for science. Each science subject is allocated four 40-minute periods per week, two periods for theory and two labs. However, girls stated that labs played a very important role in the understanding of science concepts.

A more explicit exclusion of girls during science activities was also reported to happen during physics lesson. In this class, the teacher was said to direct all attention to the boys. The student felt that the girls are to blame because they do not participate in the class either by answering or asking questions. In his opinion, once the teacher looses interest in the girls, they get discouraged.

MN: What do you think makes girls loose interest in science?

OMONDI: Maybe it is up to some of the teachers, maybe some of them are not attentive to most of the girls.

MN: What do you mean by that?

OMONDI: Let's say in our class it is boys who perform well mostly and they tend to loose interest in the girls and they are not really much interested in them. Also the girls they don't really, since we entered form three, I have not seen any girl going to a teacher to tell them that they have a problem.

MN: What did you mean by saying that the teachers are not attentive to girls?

OMONDI: During the class time, boys are the ones who answer most of the questions and when this happens, the teacher, I think feel that the girls are not interested they are not asked any question. (Interview 2, July 12, 1989)

These practices in the science class are no doubt sources of experiences that are unpleasant to the girls to whom they are directed, and their effects are discouraging. Research has shown that in mixed-sex classes, despite what teachers may think or say they are doing, boys are considered as more important, more authoritative, more deserving and worthy of attention and their understanding that they are special or important adds to their confidence while undermining the confidence of the girls (Spender, 1989).

All cultures convey images and values about men and women and the roles appropriate for them. Generally reflected is the idea that women are inferior to men. According to Dupont (1981), such inferiority may be conceived in physical, psychological or intellectual terms and is

used to justify or explain restrictions placed upon women. Female students at Jogoo High School stated that male students feel superior to them and do not accept defeat particularly from girls. A girl taking pure science and performing well in these subjects was said to be put under a lot of pressure by boys. As a result, girls and boys engage in an active struggle; in such struggles, most girls fall behind and eventually give up. One female student noted:

> ATIENO: They [boys] work harder so that they defeat us and make us failures in some way. They wouldn't like us to be superior to them.
>
> MN: Do you therefore feel that a boy will view any girl taking sciences as trying to be superior?
>
> ATIENO: Yes and therefore they try to challenge us. Challenge us by trying to compete with us.
>
> MN: You said that the boys work harder so as to defeat the girls. What makes the girls not to work harder as well?
>
> ATIENO: We [girls] tend to give up easily. Maybe in a struggle we don't tend to fight harder. (Interview 1, May 30, 1989)

It is clear that the experiences students have of science affect the images they form about themselves and help the formation of self-perception of the ability to study science at high school and at the university. Being able to study science and to pass opens up options that remain closed to students who fail to succeed in studying science. These experiences are reflected in the images they have formed of science, either as an endeavour or as a complete waste of time.

Although many Kenyan educators noted that the 8-4-4 system of education would increase the number of girls studying science in high school and in university, data are showing that there are factors that limit the number of girls studying science in high school.

Images of Science

In this section, data are presented under the following sub-headings: reasons for choosing science subjects, characteristics and activities of scientists, and women as scientists. Data from Jogoo High School show that students studying pure science at the third and fourth level of high school were selected by the science teachers. Only 6 girls were selected to study science in a class of 40 students. In Kega High School, students chose the subjects they wanted to study at this level. Girls at Kega High School were given a chance to think about the science subjects and the importance of these subjects to them. However, four girls at Jogoo High School stated that they would not have chosen to study science if they had been given the mandate to make a choice. In contrast, three of the four boys interviewed stated that if they had been given the opportunity to select subjects for study, they would have made the same choices the teacher made for them.

Reasons for choosing science subjects

The students gave various reasons for choosing science subjects. Some felt that they will need these subjects for the careers they hoped to pursue. Others stated that taking science subjects gave them a better chance for entry into universities. Students at Jogoo High did not make the choice, they were selected by their science and class teachers. That few female students were found capable of pursuing pure sciences in Jogoo High School appeared to reinforce their belief that they are not as good as boys in science and demonstrated the teachers' lack of expectation for girls to perform well in pure science in this school. The fact that the teachers in Jogoo seem to have so many positive expectations for boys and so few for girls could well be crucial.

The Kenya government is trying to encourage students to pursue science and science-related careers. As a result, those students who study science in high school stand better chances of securing a place in one of the four universities. Most of the students in Kega

High and boys in Jogoo seem to consider themselves the beneficiaries of this policy. The girls at Jogoo High and in many similar schools across the country appear to have fallen out of the competition for entry into university long before sitting for the national examinations.

MN: What can you say about the subjects [pure science] you chose for yourself?

MUMBI: I think they would be better, like for entrance to university, it is better to take pure sciences. (Interview, June 26, 1989)

MUTUA: As for the academic purposes, it is very easy for one to get into the University with sciences. (Interview 1, May 30, 1989)

Good grades in pure science subjects ensure entry into university both for students who are considering science-related careers and also for those who do *not* want to pursue science. Mumbi, a student from Kega High, noted that some of her friends are taking pure science even though they do not intend to pursue science-related careers.

MN: Is this true for only those who want to pursue a science career or what?

MUMBI: I have friends who do not want to take a science career and they are doing pure sciences all the same. (Interview, June 26, 1989)

The students recognize the options available to them if they take pure sciences and pass well in them. They also seem to have considerable confidence in their ability. These options seem to be open to a small proportion of girls in schools like Kega High, but appear to be non-existent to many students in high schools across the country. Kenya's educational system is a sharp pyramid and only a small proportion of those who enroll in grade one can survive to university. Girls in Kega High and boys in Jogoo High increase their chances of going to university by working hard to get good passes in science subjects.

Students' views of scientists and their activities

The belief that scientists are men could not be expressed more explicitly than in the language both male and female students used to describe scientists. The scientist was seen to

be male, intelligent, hard working, determined, devoted to science and also unsocial. Most students conveyed the message that in general there are few scientists and that most of them are men. It appears that the intrinsic masculinity of scientific thought continues to find daily expression in the language and metaphors students use to describe science and scientists. As Keller (1985) noted,

> When we dub the objective sciences "hard" as opposed to the softer (that is, more subjective) branches of knowledge, we implicitly invoke a sexual metaphor, in which "hard" is of course masculine and "soft" feminine. Quite generally, facts are "hard," feelings "soft." Feminization has become synonymous with sentimentalization. (p. 77)

One female student felt that scientists are not social people because of the demands of the career.

> MN: What do you think are the activities of scientists?
>
> ADHIAMBO: I do not know many scientists but it must be that they bury themselves in books and get to research and expound on their knowledge . . but I don't really think they have much of the social life. (Interview, June 26, 1989)

When I inquired why she thinks that scientists do not have much of social life, she replied:

> ADHIAMBO: I do not see them having any social life and I do not think they are very social people. They do not get along with other people and mostly if they get partners I think they find it hard to live with them.

The scientist was also seen to be male, intelligent and hard working.

> MN: What do you think are the characteristics of scientists?
>
> ADHIAMBO: I think a scientist is a person who is fast in learning and devoted to science and likes his job. (Interview, June 26, 1989)
>
> NDUKU: I still see the scientist as a man because I have not seen women scientists.
>
> MN: What do you consider to be the characteristics of a man?

NDUKU: Hard working, a person who likes to think. (Interview 2, June 15, 1989)

Mbithe, a female student from Jogoo High school, noted that scientists are great people and that she did not see how she could do anything that would be considered great. She considered activities such as labs in science as repetitions of what scientists have already done. It is evident that in most science textbooks there is very little if any at all of women's experiences in the making of what is scientific and it appears that this student in particular and others who have had similar experiences do not see how they can become scientists.

MN: What about scientists, what do you think are the activities of scientists?

MBITHE: I just find them to be great people

MN: What do mean by great?

MBITHE: Because of what they have discovered and what they have also done.

MN: Like what?

MBITHE: If for example we do an experiment in the laboratory, you just find it to be like some sort of magic (Interview 1, June 8, 1989)

Male students did not have any difficulty in identifying themselves with scientists and so they described the scientist as a male, curious and inquisitive person who is interested in science and prestige.

MN: What do you think are the characteristics of scientists?

WEKESA: He is quite interested in science, if something happens ideas just come to him that lead him to know how and why such things happen. (Interview 1, May 30, 1989)

MN: What do you mean when you say that scientists do not loose hope even when experiments are not working and dangerous?

MUTUA: Most of them are more interested in prestige and this makes them not to give up easily although the experiments might even cost them their lives. (Interview 1, June 12, 1989)

Most students felt that scientists engage in research mainly to improve life. A female student referred to activities of scientists as "battling with phenomena." The students also felt that the activities of scientists are demanding and time consuming. Such activities were seen to be incompatible with the roles a woman plays in the family as a wife and mother.

MN: What do you think are activities of scientists?

ATIENO: A lot of work is required when you are a scientist. There are a lot of researches you need to do when you are a scientist unlike a secretary. You have to spend a lot of time on the job and also money.

ATIENO: He [scientist] spends a lot of time outside not with his family, a lot of time is used in doing the research work.

MN: Why do you think that most of them are men?

ATIENO: Men do not have a big role to play in the family and so they find it easy to spend time. They take themselves as not part of the family that is not so needed.

MN: Do you mean that the scientist cannot have a family?

ATIENO: Yes but the nature of their [scientists] work is too involving such that they do not even take weekends off, maybe they have something to complete, they cannot just wait to do it after a weekend.

ATIENO: He needs a lot of time because he needs to concentrate. He is supposed to be somebody who is determined so much and have high intelligence. (Interview 2, June 20, 1989)

The activities of scientists were seen to be very important to society, especially in trying to find cures for dreadful diseases like AIDS. As such, scientists are seen as battling phenomena for the benefit of the other members of society. This makes the activities so crucial to the survival of the global society. It is not surprising that Mbithe, the female student from Jogoo, felt that scientists are great people and that she cannot do anything that would be considered great, such as "battling phenomena."

The following statements illustrate what some of the students considered as activities of scientists:

MN: What do they research on?

NJERI: They do research on medicine. Like now they are trying to get cure for AIDS. (Interview 1 June 6, 1989)

MN: What do you think are the activities of scientists?

MUMBI: They do research, mostly research and on how to make the world a better place. (Interview, June 26, 1989)

WAMBUI: I think they try to find ways of making life a better place more enjoyable and the world a better place through discoveries like for diseases they find cures. (Interview, June 27, 1989)

MUENI: It's like battling the phenomena of the world like the ones that are unfavourable to you to be able to lead a better life like conquering diseases and finding ways to prevent drought and building a good place for yourself to live in. Just to make life a little better.

MN: Why do you consider the activities as "battling"?

MUENI: Battling because the world is naturally harsh and we cannot go out there and everything is favorable to us and for example the sun all those rays they are unfavorable to you. You could get skin cancer for example and that is unfavorable to you. (Interview, June 29, 1989)

It appears that most female students at Jogoo High do not have the confidence to engage in "battling" phenomena. The conditions under which victory is to be achieved, time at the expense of a family, do not allow women to participate fully in these scientific activities. The Kenyan society does not expect women to engage in such activities and therefore has not been encouraging them to participate. Instead, the Kenyan society expects women to be wives and mothers.

Statements such as "men don't play a big part in family life," "mostly they are not around most of the time," and "though their family does need them but not as much as the mother" were all too commonly heard during the interviews. This appeared to be an indication of the students' understanding of society's different expectations for men and women.

In Kenya, there is still that strong feeling that a girl who goes to school and pursues a career and later on fails to fit in married life, is not fully educated. Such a girl remains a disgrace to her family and community. The lack of compatibility between the expectations for a wife and mother and those for scientist can result in ambivalence for girls who would like to become both scientists and wives and mothers. It is not surprising that those who choose to become wives and mothers frequently perceive their future as non-existent. This is partly due to the sharp division of domestic labour, women who have chosen to become wives and mothers do not have time which is one of the major resources for their personal career development.

The male students also felt that activities of scientists are time consuming but this does not inhibit men in any way. Men have time to engage in these activities and at the same time have a family. The students noted that it would be difficult for a woman to be a scientist as well as a wife and mother.

> *WEKESA*: With sciences you have to do researches and maybe leave your country to attend meetings. She [a woman scientist] cannot leave her kids to attend these meetings.
>
> MN: What about a woman scientist? Would she be able then to cope with this career?
>
> *WEKESA*: With the African tradition, women are supposed to stay at home and not to move up and down. They are supposed to get home and look after the children. (Interview 1, June 12, 1989)

It appears that once one chooses to be a wife and a mother, it becomes difficult for her to develop her career because motherhood is perceived as an ongoing activity, which begins rather than ends with the birth of a child and demands years of a woman's life.

Women as scientists

Most students felt that women are capable of becoming scientists. Nonetheless, the under-representation of women in scientific activities and careers promotes the belief that most women are not capable of becoming scientists. Some female students, especially from Kega High, felt that women possess all the characteristics required of scientists, such as precision and patience. However, Mutua a male student felt that women are not as intelligent as men and that this is supported by what he has seen in Jogoo where there are only six girls studying pure science. The activities of a scientist were seen to be incompatible with motherhood. Students stated that it is not possible for a woman to participate fully in the dual responsibilities that are both demanding. This was seen as a probable reason for under-representation of women in science and other science-related careers. Students noted that under-representation of women in science is a result of the structures constructed by society but not a question of inability; this under-representation results in lack of role models in science for girls. Therefore, the students felt that those women who would like to be scientists have to rid themselves of the belief that women are not capable of becoming scientists and be very determined. The following statements are what some of the students said about women becoming scientists:

MN: Do you think women are capable of becoming scientists?

MBITHE: They [women] are capable if one is determined, they can make it. (Interview 1, June 8, 1989)

MN: Do you see women becoming scientists in the light of this?

NDUKU: Yes on condition that they discard the idea that men are the only ones who can become scientists. (Interview 2, June 15 1989)

Mutua, a male student felt that women are not as capable as men of becoming scientists because naturally women are not as bright as men. He also noted that what society expects of women in a family setting does not allow them to participate in science careers to the same level as men. This idea was developed in the following discussion:

MN: Do you see women being able to pursue science careers?

MUTUA: I think the women think they are not capable of doing science. Like in our school here, since we came to form one most girls have been saying that science is difficult

MN: Do you think that the girls are not bright?

MUTUA: They [girls] are, but not as bright as the boys.

MN: Why do you think it is like that?

MUTUA: It is natural.

Mutua asserted that girls steered away from science careers because of family anticipations.

MN: In your view are girls then capable of pursuing science careers?

MUTUA: Girls can pursue science although they are neglecting it so much. They feel as though it is difficult because in science you become so occupied such that it would restrain them from certain obligations. Like when girls become women they have to look after the home and children and they can't spare sometime for participating in science. (Interview 2, July 11, 1989)

The low number of women scientists and exclusion of their work in science, especially in science textbooks, was seen by some male students as a probable reason for girls not seeing themselves as future scientists. Boys noted that they have more role models in science that encourage them to perceive themselves as capable of pursuing science and science-related careers than girls, especially those in Jogoo High. They noted that girls tend to feel that pursuing

science careers is a waste of time since they have not seen many women who have succeeded in science and science related careers.

MN: Could it be that the science subjects are written in certain ways that favor the boys?

MUTUA: No. The boys just become interested in science when they start thinking of what to do in the future.

MN: What makes them to get interested in science?

MUTUA: Maybe they [boys] want to be a future scientist after reading or hearing of some past former scientists. You see, pursuing a science career, one is assured of a good salary and an admirable status in society.

MN: What makes the boys feel confident to pursue science careers?

MUTUA: The boys see other boys who have made it or have been successful in science careers. The girls only have dreams and the boys have evidence. I think it will take time to have the girls equal the boys as is the situation now. The boys are still increasing and it will be difficult to decrease the gap of girls and boys in science. (Interview 2, July 11, 1989)

Wekesa noted that girls do not have role models.

WEKESA: Maybe ladies they don't see, when they read the books, they see people like Sir Isaac Newton and they do not see any lady quoted as having contributed so much to science. This maybe discourages them. But like us, we want to be like those men. We have examples in record. (Interview 2, June 23, 1989)

This is consistent with Adler,(1982), who noted that "men have decreed what we know. We know so little about the achievements of women and especially in science" (p. 5). Spender (1982) makes a similar point that while men are the policy and decision makers, and while education remains under male control and men decide what is important, we will not know about women

such as Mary Somerville, who translated Newton's work for lay people and was one of the leading scientists of her time.

Omondi, a male student, felt that although women might be capable of becoming scientists, they do not often become scientists because they do not like science. This dislike for science was seen as due to peer relationships that girls tend to involve themselves with when they get to high school. The girls spend time nurturing these relationships rather than reading science which needs a lot of time.

> MN: What do you mean by saying that girls get spoilt?
>
> *OMONDI:* Girls indulge themselves maybe in relationships with boys, by the time they reach form one, they will start hating subjects like chemistry, mathematics but they do not take interest in them.
>
> *OMONDI:* Most of the girls around our place just like going to discos, something like that, with their boy friends giving them money, and I think that is the thing that is discouraging them from doing sciences. (Interview 1, June 5, 1989)

Girls are seen primarily in terms of their sexual reputation rather than in terms of their human qualities and attributes, and they are described as either "good" or "bad" girls. According to Lees (1986, p. 53), the double standard of sexual morality constrains every aspect of the girls lives—relations with boys, friendships, school work and social life. Girls who are actively involved in relationships with boys as well as those who are unattached are treated with contempt by the boys.

> MN: Why do you think girls do not like science subjects?
>
> *OMONDI:* I think they don't like subjects that make you think most of the time. (Interview 2, July 12, 1989)

The female-male contrast suggested here seems similar to that suggested by Byrne (1987, p. 21): "Words [and people] are the daughters of men and women, and things [and ideas] are the sons of men."

An ability reconcile a career, especially one in science, with her family appears to be crucial to an African woman who knows that she has to "settle down" and raise a family while pursuing her career. Wekesa, a male student, felt that this was one factor that deters girls at Jogoo High from pursuing science careers and from becoming scientists.

MN: What is it about science that would make ladies withdraw?

WEKESA: Sciences take a long time. There is a lot of research to be done and the ladies might feel that it is taking them too much time to complete or to get somewhere. An African lady would admire having a family and at the age of 30 they would get discouraged with it and probably quit to get married.

In contrast to male students at Jogoo High School, female students from Kega High school felt that women are capable of becoming scientists because women possess all the characteristics of scientists and have the same capabilities.

MN: Do you see women as capable of becoming scientists?

MUTHEU: I believe that women are bright and more patient than men and particular and efficient in most areas and science included. So I do not think they would find any difficult in drawing conclusions.

Also, students felt that however much a woman might want to be a scientist, the task is heavier if she also decides to have a family.

MN: What about if she [female scientist] will have a family?

MUTHEU: I think then there will be a problem. . . because first and foremost in the course of the work or the experiments and other tasks they do may inconvience her as a mother and she might not give them all the attention they require from her because I think it is quite demanding. (Interview, June 21, 1989)

MN: Do you feel that if you pursue a career in science it will be too demanding to enable you to lead a normal family life?

MUMBI: I think sometimes it depends on which one [science career] one is able to take, and whether one can balance themselves between job and home. Although I think it would be a bit pressurizing so you have to be patient. (Interview, June 26, 1989)

Most science careers in Kenya are dominated by men and it is assumed that when women get married and start their families their careers are disrupted. Many women who live under patriarchal guidance are not encouraged to pursue science careers. The influences of these mothers are often passed on to their daughters. These preconceived ideas have discouraged many girls from participating in science careers.

MN: Why is it then we do not have so many women pursuing science related careers?

MUMBI: I think that some [girls] as of their backgrounds are discouraged from activities which seem to be male-dominated. Others are afraid to take the plunge and yet others want to take care of their families without pursuing careers which are too pressurising and taking too much of their time from their families. (Interview, June 26, 1989)

Students felt that it is important for girls to decide what they really want to become in future. They noted that girls should choose either a family or a career in science. According to one student, men can have families and pursue the careers because women are expected to sacrifice their careers for their families.

MN: It therefore seems that it is not a good career [science] to pursue if you are a woman and you want family life?

ADHIAMBO: I think if you think that family life is most important I don't think . . . but you can try but I don't think you'll be able to do as well. I think this is one of the reason why men have been able to advance in sciences because they are not all that interested. O.K. all men want to have a wife and children to lean to in the future but

they can afford to have a woman and children but not pay so much attention to them but a woman she knows that if she takes her career first and she would also want to have a family, chances are by the time she establishes herself with the career, all the men would be gone. So most of them take subjects which will allow them to fit in with their husbands life. (Interview, June 26, 1989)

Dale Spender (1982) observed that many girls do not perceive any alternatives to being wives and mothers. She noted that girls are bombarded from birth with the message that they must be mothers and are channelled through education to plan for their futures in terms of child-rearing rather than employment.

Socially, women are associated with a "warmth-expressiveness" cluster of attributes such as gentleness, emotionality, and subjectivity (Broverman & Vogel, 1972). Female students noted that this characterisitic of women influenced their career anticipations. The female students noted that these attributes of women lead them to pursue careers such as mothering, nursing, and teaching that allow them to express their emotions.

MN: Do you think that the unsocial nature of scientists could discourage most women?

ADHIAMBO: I think women are basically more social and they concentrate more on the social basis of life and not so much intellectual . . . like getting together meeting friends and exchanging ideas.

MN: Do you think that this might be one of the reasons which make women to pursue careers which involve handling people like nursing and teaching?

ADHIAMBO: Yes because it gives them [women] a chance to interact with different people and show their emotional affection and instincts. (Interview, June 26, 1989)

Since most scientists are men and they are believed to be very intelligent, women who pursue science careers are considered unique or even "unfeminine." Female students at Kega High

School stated that most women fear to be branded as being "unfeminine" if they pursue science careers.

> MN: How do you think the men will take you as an architect?
>
> WAMBUI: Most men do not like women who have achieved greater heights than they have so they might look at you in a bad way.
>
> MN: What do you mean by that?
>
> WAMBUI: They might see you as being unfeminine, trying to be like men but you are not and they would try to frustrate you.
>
> MN: You said that there are some careers which women feel they are not for them . . . they are to be pursued by men. What makes women feel like that about certain careers?
>
> WAMBUI: I think for many women their goal is, after achieving what they want they would like to settle down and have a family but once you find yourself achieving so much like being a doctor or a scientist, it becomes hard for you to join in the normal life. Men will look at you in a bad way and it wouldn't be easy for you to get somebody to marry you and all that and I know women fear that and the shame of remaining single. (Interview, June 27, 1989)

Although policies have been passed to encourage women to pursue careers that are male-dominated, data shows that there are still factors and structures that influence girls to steer away from science and science-related careers to other quintessential female careers.

Science as a Career Option

The careers that high school students choose to pursue are dependent on their experiences in several disciplines during the course of their high school. Furthermore, a student's experiences in science may be influenced by several external factors other than those confined to the classroom. This section will present the differences in the choice of career between male

and female students at Kega High School and at Jogoo High School, while highlighting the factors that may affect their choices of career: factors internal to the classroom and factors that are external but have been woven into Kenyan society, entrenching the age-old tradition of gender-specific careers.

Students were asked about what they anticipated doing after high school. The students' responses fell into two categories: higher education in university, and vocational training in commercial colleges. Four of the six girls in Jogoo High School taking pure science subjects want to do accounts—a business course taken immediately after high school. The other two would like to go to university for medicine and a general degree in science. Of the four boys who were interviewed from this school, three would like to go to university, two to study medicine and one to study computer science. The fourth boy would like to train as an accounts clerk in a commercial college immediately after high school.

On the other hand, of the 10 girls interviewed at Kega High School, all but one would like to go to university. In the university, all except two want to pursue science and science-related careers. They described these careers as interesting and challenging. In Jogoo High School, the girls who wanted to do accounts said that they felt that they will not manage to go to university because of high competition for the few available places. The lack of opportunity for higher education seems to limit these girls aspirations or at least reconciles them to less attractive jobs. The following is what some of the girls in Jogoo High School said about their inability to qualify for university entrance.

> MN: Is it that you do not want to go to university?
>
> NJERI: Yes, because the university has a high competition and I feel that I cannot make it.
>
> NJERI: Because they are expecting high marks and in chemistry I cannot make it to get that high mark they want. I think they want grade B- in everything. (Interview 1, June 6, 1989)

Reasons for choosing science related careers

Most students in Kega High felt that the careers they would like to pursue at the university were not only interesting but challenging. The careers described as challenging are those that are science or science-related and traditionally male dominated. One such student from Kega High stated that the career she wants to pursue is very challenging as there is only one native Kenyan actuary and he is a man. It would be challenging in that she would likely be among the first female actuaries in Kenya.

The dominant ideology tends to encourage girls to pursue the more "feminine" careers such as teaching or nursing. There is support and evidence that girls at Kega High school can pursue careers that are not considered "feminine." The plaques on the walls of the dining hall bearing the names of students who have studied at Kega High and the careers they've studied are the evidence. Some of these plaques bear names of girls who were in that school in the late 40's and most of the girls have pursued careers that have always been male-dominated in universities abroad and in East Africa. Even so pursuing such careers is taking up a challenge as is expressed by students aspiring to pursue these careers. They had the following to say:

> MUMBI: I thought it was challenging. My mother told me that there is only one Kenyan actuary and all the rest are expatriates and the one who is a man. So I thought it would be most challenging and I also like mathematics very much and also at least one is assured of a job with it. (Interview, June 26, 1989)

Another student aspiring to pursue engineering stated that the career is challenging.

> MN: Why do you want to do engineering?
>
> ADHIAMBO: Because for one it is very challenging. . .

Adhiambo also stated that she would not like to pursue careers such as teaching and office work because they are boring and monotonous.

> ADHIAMBO: I don't like things which are monotonous. But in engineering, I am going to see different aspects.

Aware that these jobs that she considers monotonous apparently are the ones that attract most women, in her opinion, this student noted that women like to pursue these careers. She said that women are weak, give in easily and settle for such careers that most men do not like to pursue.

> MN: But these are some of the careers [teaching and nursing] which attract many women?
>
> ADHIAMBO: I think it depends on the individual but I don't think I would like such a life. I think most women are weak and they give in too easily, that's why they go for the easy jobs which they hope will offer them security . . they know I will do this from 8.am- 4.00pm. Engineering I don't think they like it because it is not really secure because you have to make decisions on your own but teaching everything is laid out there for you. There is no challenge because you are teaching things you've go through before so many times.

She goes on to say:

> ADHIAMBO: I think it is because we easily accept defeat, not really, but we accept to be the weaker or to take the lower part in society because men try to look bigger like they are the leaders in our society. I think women are weak and decided to fit in with what men want so they just go along with what men plan for them and they do not want things changed. (Interview, June 26, 1989)

The preceding comments made by Adhiambo, a female student at Kega High School and the evidence at Kega High School suggest that female students at this school are aware of the much adhered to gender-specific choice in careers and are attempting to break away from it.

Statements such as "we easily accept defeat," "we accept to be the weaker," and "men try to look bigger" suggest that for a woman to pursue science careers, she has to resist defeat and can only do so by being "strong." This could be the possible basis for the belief that science and science-related careers are challenging. Female students at Kega High therefore seem to

recognize that entry into male-dominated careers, as difficult as it may be, is a form of "emancipation."

Medicine was seen as a career that most students studying science courses at high school plan to pursue because it is the only science career that students seem to know of. Some students regretted that they do not get counselled and so they are ignorant of which careers are open to them:

> MUENI: I think it is because they are exposed to this one science career. As soon as sciences are mentioned, medicine comes in. They do not think of something like engineering.
>
> MUENI: We are not informed of what careers there are open to us. We should be counselled which we never are. What they do is they give you the forms and say if you have a B in this then you are good in this. You really do not know. (Interview, June 29, 1989)

In Kenya, career guidance and counselling is the responsibility of an appointed teacher in the school. This teacher is supposed to give guidance to students about careers and at the same time teach his or her subjects. Often, this teacher does not find time to inform students about career options open to them, also this teacher does not have adequate knowledge of the existing careers. As noted this teacher does not find time to advise students on career opportunities until the last term of high school when students are required to complete career forms. As a result, female students are more likely to choose science careers that other female students have chosen, such as medicine rather than engineering. Robertson (1988) attributed such phenomena to the rigid sexual division in employment. She notes that "despite an increased awareness of the harm caused by restrictive gender roles and despite substantial efforts to redress bias in school systems, outdated ways of seeing the world cling tenaciously to our students and our institutions" (p. 2).

This points clearly to an anomaly in Kenyan education policy: although Kenya reiterates her stand of providing opportunities to all people regardless of sex, race or religion, it is not clear if girls in most other schools are being encouraged to pursue non-stereotypical careers to increase their job opportunities.

The students also seemed to base career choice on the subjects in which they were doing well and also on the wages paid. Students felt that science and science-related careers have attractive remunerations:

WAMBUI: Recently I have been thinking of architecture instead of medicine. It [architecture] has a nice pay and I believe I am capable. (Interview, June 27, 1989)

Even though the male students interviewed had the same careers in mind as the girls at Kega High School, their choices were for very different reasons. Male students stated that they would like to pursue science related careers that tend to be male-dominated. One male student noted that he would not think of nursing as a career for him. He would rather be a doctor for most doctors are men and nurses are women.

MUTUA: I wouldn't want to be a nurse it has too many women. I like medicine and I am going to be a doctor. (Interview 1, May 30, 1989)

MUTUA: Maybe it is because men like to feel higher and you wouldn't see a man wanting to be a secretary, in that field many women become secretaries. The man would prefer to be the boss or to be the personnel officer or anything higher than a secretary. Or a permanent secretary. He would like to be the boss.

MUTUA: You see in the African point of view, men are considered to be superior than women and so you wouldn't like if you are a man to be under a woman. (Interview 2, July 11, 1989)

Here the male student begins to exemplify what appear to be the two sides of the man-woman relationship. He supports the common ideology of African patriarchal society that

women are subordinate to men, and this is evident in men's choice of careers—careers they choose maintain their dominance over women.

It was also observed that even when boys are not sure of what career they would like to pursue, they still envisage themselves doing what appears "normal" for boys, studying sciences—pursuing science or science-related careers. For example, a male student in Jogoo High who was not sure of what specific career he wanted to pursue, noted that he anticipated pursuing careers that one taking pure science is expected to pursue. He felt that he was capable of pursuing any of the following careers depending on his choice. He considered the following careers:

> *OMONDI*: Mechanical engineering, electrical, or biochemistry . . . but in my future I want to be a scientist. (Interview 1, June 5, 1989)

The male students clearly hold to the dominant ideology: they did not want "feminine" jobs, and they regarded as normal for boys to pursue science and science-related careers.

Students also expressed the need to pursue careers that would enable them to secure employment after university graduation. Out of necessity, some students felt that they needed to pursue careers that are not pursued by many people. These are careers that are science oriented and they are the same careers that the Kenyan government is encouraging students to pursue for national development.

> MUTHEU: Well, I just look it up myself and see that so many people are wanting to be doctors, lawyers or teachers and I think that in future there will be too many of these people and it will be hard to get an employment. So I wanted to take something that not so many people are doing or interested in. (Interview, June 21, 1989)

The concern to secure employment after graduation is not surprising, and is the result of the high rates of unemployment in Kenya. During the colonial era, Kenyans saw European systems of values and schooling as a source of "salvation" both from poverty and inferiority.

Kenyans now realize that a degree does not guarantee a job since most university graduates do not get jobs for long periods of time after graduation. The lack of immediate employment for graduates has increased doubts in the importance of university education. For example, the 1989 graduation ceremony in Nairobi University's Great Court was later described by the local newspapers as an event during which the graduands were conferred with the power to read and write but no power to secure jobs and live to great expectations (Standard Newspaper, November 25, 1989, p. 12). This is an indication that, although there is stiff competition for the few places at the top of Kenya's educational pyramid, competition for jobs is even greater.

Possible reasons for not choosing science careers

There is a belief that most girls cannot manage science in high school and therefore are not capable of pursuing science careers. This was made a reality by the unpleasant experiences for the girls at Jogoo High School. Also, most students who are not aspiring to higher education do not see the usefulness of science. Additionally, some female students noted that there are some careers that women would like to pursue but fear being discriminated against in getting jobs. The following excerpt illustrates this feeling.

> WAMBUI: Well I think we can take it (mechanical engineering) as women, there is nothing to hinder us although they might discriminate us in giving us the jobs as they feel that the men are better suited for the job than women.
>
> WAMBUI: I think that we should not be discriminated in being given jobs. It is this discrimination which causes us, we women to disregard the science subjects because we feel that even if I make it, I will not be given the job because I am a woman [the phrase in here provided the title for this thesis]. We should have the same job opportunities. (Interview, June 27, 1989)

Women who have ventured into some of the male preserves such as mechanical engineering or motor mechanics have been snubbed by customers. An incident that supports the

student's feelings occurred when a man took his car to a "jua kali" (open air) garage for service and refused to have it attended to by a female mechanic. He insisted he wanted a male mechanic to attend to his car. This clearly indicates discrimination against women in the work place.

The responses of these girls show how external factors, like societal pressure to maintain the division of labor between males and females, play a major role in students' choice of careers. For fear of job discrimination, capable girls could shun science-related careers. Jane Gaskell (1987) found that female students in her study made decisions to pursue traditional feminine paths based on their knowledge of very tangible structural conditions such as the opportunity structure in the labour market, the existence of sexual harassment in male occupations, and the assumption of family responsibilities by women (p. 164).

Some students, especially female students from Jogoo High School, seemed not to consider science careers as viable. For example, Mbithe did not see the usefulness of science if she was not able to go to university.

> MBITHE: All other subjects I don't see any other thing that I can do, the subjects that I am doing now. For example if I am not going to the university, what other combination can I do in a college?
>
> MBITHE: Let us say I finish, and then I do not go to the university, where else can I go with physics? (Interview 1, June 8, 1989)

Mbithe's statement is one of despondency.

"Women can be scientists, but I cannot"

This heading comes from statements made by female students at Jogoo high school about the possibility of their becoming scientists. Although female students felt that women are capable of becoming scientists and that there is nothing innately hindering women from becoming scientists, some female students, especially at Jogoo High, appeared to be totally convinced that they were incapable of pursuing science and science-related careers or becoming scientists.

Mbithe felt that it would be impossible for women to pursue science careers such as engineering that are still male-dominated.

MN: Do you feel that you possess any of the characteristics of a scientist?

MBITHE: Not really.

MN: Do you see women becoming engineers?

MBITHE: No.

MN: Why?

MBITHE: I do not know. (Interview 1, June 8, 1989)

The government's policy to make science compulsory was aimed at increasing the number of students, boys and girls studying science in high school and pursuing science and technology careers. Most female students in Jogoo High School have had experiences of science that are unpleasant, and do not feel competent to pursue science and science related careers.

Family, Paid Work and Partners

Even though 14 of the 16 girls interviewed proposed to be professional career women, they realize the difficulties of trying to balance motherhood and a career. Their fear of antagonizing "male superiority" is also highlighted. The students were aware that it would be a disgrace not to have a family by the age of 27. All but two female students anticipate having a family after pursuing a career. One girl from Kega High expressed her intentions of having a fulfilling career rather than a family. Girls noted that pursuing a career was of primary importance at present. The girls also were aware that they would be expected to work to increase the total income of the family. However, they noted that most men would not like to marry a spouse who had a larger income preferring rather that she had a smaller income. Girls at Jogoo High School saw their roles in the family primarily as mothers and wives but also helping their spouses. The students had the following to say:

ATIENO: I will also provide for the family because in the current society there is no man who would like to marry a woman who is not working because it would be too much for him. Otherwise it was for the man to provide for the family and the woman to stay at home with the children.

MN: Do the girls know that the men would not like to marry a woman who is not working?

ATIENO: They know it, it is what is happening and we have seen this. Also they wouldn't like to marry a girl probably who is more educated than them and probably earning more. They do not want to be ruled over by a woman. Boys do not like defeat and would feel like they are defeated if a woman earns more than them. They do not like this inferiority, the woman being greater than them. They want to be the cocks of the family the heads and the person who leads in everything. (Interview 2, June 20, 1989)

MUMBI: I think it is embarrassing to a man because most men are the ones who have to bring the money home, the ones who have to support their families and all that. (Interview, June 26, 1989)

WACHERA: They tend to think that they may be ruled by the woman. (Interview 2, June 15, 1989)

MUMBI: I think that when men are looking for a marriage partner . . . they also want somebody who would match them intellectually not somebody who when they talk about their work they would not understand one who can be more equal to them in most ways. (Interview, June 26, 1989)

Since the introduction of paid labour, women have found themselves relegated to the unpaid or lowest paid spheres of work. As a result, women and children cease to be able to live autonomously in a world that runs on the money to which they have such restricted access. This hierarchical relationship between men and women that submits women to dependence on men

is a result of women being channeled into support-like jobs. Girls at Kega High School want to pursue careers that will not enhance their dependence on men. However, these girls see themselves as the ones who will be expected to put more time into the family than their spouses. The girls have seen that it is the women who have to spend time with their families. A female student notes:

> ATIENO: Children rely on their mothers more than on their fathers not for money but because motherly love is greater than fatherly love. The children need the fatherly love but more so motherly love. (Interview 2, June 20, 1989)

The following statements indicate what girls expect their role in the family to be:

> MN: What role will you play in your family?
>
> WACHERA: As a mother taking care of the children and the home.
>
> MN: Taking care of them in which way?
>
> WACHERA: When they are sick, cooking for them and making sure that they are comfortable. (Interview 2, June 19, 1989)
>
> NDUKU: Not only a mother but . . . try to teach children what is right and wrong and also work. (Interview 2, June 15, 1989)

Marion Scott (1980) noted that cliches such as "motherly love is greater than fatherly love," have been used to associate the social role of women with the biological fact of childbirth so that it appears "natural" for women to be engaged primarily in housework and childcare (p.97).

All the girls felt that it is very important to have a job even after getting married because a job provided them with security and independence. They noted that it was risky to rely on a husband for total financial support because he could die or marry another woman and she be neglected with her children.

> MN: What will happen if he [husband] tells you not to work?
>
> NDUKU: I will not agree to that. (Interview 2, June 15, 1989)
>
> MN: Do you feel that work would give you freedom?

MBITHE: Yes. To be working is good.

MBITHE: He [husband] might turn to be irresponsible, he might die. Anything might happen. (Interview 2, June 16, 1989)

Denying women the opportunity to work has been one way of keeping them dependent to men. The female students expressed their desire to be independent but within limits. The girls realized the "domestic struggle" that they will have to wage in order to have a career, while maintaining a family and some semblance of peace in the home.

The assumption that girls will have primary responsibility for domestic work, for child care, and for housekeeping is held by both boys and girls, although the male students clearly support the notion that "a woman's place is in the home."

OMONDI: The woman may be also working that is if we will afford a maid although the children will lack that mother's love. My wife will work under circumstances maybe I'm not able to provide for the family fully. (Interview 2, July 11, 1989)

In most African traditions, it is assumed the man is the overall head of the family and should have control of all matters relating to the family. With the introduction of paid work, the men still feel that to maintain the control of the family, they should control all the family income and expenditure. They should also be the ones who contribute more, in any case most women are not paid as well as the men. However, if a woman was more gainfully employed than her spouse, her financial independence is likely to be perceived as unfavorable to the stability of the home because the man's position as the head of the home is challenged. Mbithe, a female student stated:

MBITHE: Because it is just there that people feel that the men should be the ones who earn more. Therefore a man will want to marry a woman who he feels is of low standard than himself. (Interview 2, June 23, 1989)

Marrying a woman who is not working was seen as an advantage because she would have enough time for her children, especially for daughters. A male student noted that:

OMONDI: Her role will be maybe to get the children and advise them. Especially the daughters, she should advise them, I am not the one to do that.

MN: Would you marry a woman who is not working?

OMONDI: It would be good to observe her daughter's behavior and advise them. She would have more time to do that than if she was working. (Interview 2, July 12, 1989)

This male student's expectations of his spouse is consistent with the traditional education system in which the mother was expected to serve as a role model to her daughters to teach them their future roles in traditional society. For example amongst the Kikuyu:

> Much of the educational activities consisted of play. . . [children] often imitated their elders in play, as it were, in anticipation of their future lives. The games served as a rehearsal of the activities which were carried out in real life. [Boys] engaged in mock fights or raids using small wooden spears, shields made from banana tree bark, bows, arrows, strings and stones. Girls [on the other hand] plaited baskets of grass and ground corn imitating their mothers; they modelled small clay pots and cooked imaginary dishes. . . (Sifuna, 1976, p. 19)

The male students know that they will not have to quit their careers at anyone time. They do not have to be with the children. A little time in the evening after work is sufficient as is indicated by the following statements made by a male student.

OMONDI: One has to spent most of his time with the children. If you have left work at 5 p.m, you make a point of coming home early to help the children with their problems. (Interview 2, July 12, 1989)

Only one female student from Kega High stated that she would rather have a fulfilling career than a family.

ADHIAMBO: Well, maybe it is part of my nature but men are not that bad but I would rather have a fulfilling career than sit around day and day—such a monotonous way

of life. I would like to be fulfilled personally but if I got the type of man who is willing to sacrifice and who understands what I want, I mean it's O.K. To me I do not think it is an essential part of life, I can go through life without it.

Although she knows that staying single could be interpreted as being unsocial. She noted:

ADHIAMBO: I will not bury myself or hide myself from the society. I would like to be part of the society and enjoy life as well not just concentrate on books because after all you can get all the knowledge you want but if you don't know how to live and relax and you enjoy yourself I think you do not know the meaning of life. (Interview, June 26, 1989)

There is that strong feeling that a girl who only goes to school to acquire "book learning," and later fails to fit in married life is not fully educated. One female student from Kega High noted that when she talked to her parents about studying medicine for a career, they sounded quite doubtful. They felt that she might be unable to complete the program. The student interpreted their fear as concern that she might be too old for marriage when she graduated:

WAMBUI: I spoke with my parents about medicine and they saw as though it will take a lot of time. They did not oppose but you could hear them say that "are you really going to make it" because of the time factor.

MN: Why did they think you couldn't make it, what would you be hurrying for?

WAMBUI: They might feel that by the time I finish I might be 30 years and too old for marriage.

MN: What did you think about that?

WAMBUI: Well I considered it but I did not think it is relevant at that time.

She however noted that she liked architecture because it will not take a long time to finish, though would feel that she has achieved more if she takes medicine.

MN: What about architecture?

WAMBUI: I like it because it will not take that much time to finish.

MN: How many years do you think it will take?

WAMBUI: I think something like four years unlike medicine where I have heard some people take even twelve years to qualify as consultant or to establish yourself as a doctor.

Here we see how the family and society continue to influence young people in making decisions about their future. For example, Wambui's parents implicitly influence her career horizons, by narrowing them, as she begins to view herself as a mother.

The data on Kenyan students' views of the nature of science clearly show that there are difficulties that girls experience as they study science in high school and anticipate to pursue careers that are in science and science-related fields. These difficulties are unique to girls and are more pronounced at Jogoo High School, a co-educational school. The girls who succeed in their first struggle and pursue careers in science and science-related fields are faced with yet another struggle: the struggle to balance a career with wifehood and motherhood. These two struggles are discussed in the next chapter.

CHAPTER 6

INTERPRETATION

I begin this chapter with a short narrative of a woman's struggle—that of my mother! My mother's story is a classic story of a Kenyan peasant woman, born into a large family in a small village in Kenya in the year 1919. Social and economic opportunities for women of this generation were extremely limited. This was the period when both the colonial powers and the patriarchal control of traditional authority (chiefs and elders) served to keep women in the home. Under traditional law, women were denied access to land and capital. Women's roles were clearly defined as wives and mothers. A woman played a key role in agricultural subsistence production, rearing of the children, and in the general smooth running of the household. However, this does not deny domestic struggles that these women engaged in. As a child I realized the daily struggle that my mother's life involved. Having been denied by her father the opportunity to exploit her potential as her brothers did, and also denied employment opportunities by her husband, my mother's struggle to provide food for the family was aggravated by the impact of Westernization on the traditional life styles.

My mother's struggle as a peasant to provide food for a family of 11 children, some of whom were step-children from my father's second wife, had a forceful impact on me. Traditionally, her children would have helped her in the production of food for the family but such help was not available because they had to go to school. She needed to hire helpers, and total dependence upon her husband's income for financial support to hire a helper intensified her struggle. My father, who was a chief inspector of police, chose to deny her this support. The only help she had was from her older children on Saturdays only, as the other days they were in school. She toiled each day of the week on the farm to produce the food we needed. She watched the seasons and prepared the land, planted, weeded and harvested virtually unaided.

My mother, like most of the married women in Kenya between the periods 1940 and 1950, did not have her own income because my father, like most men at this time, did not allow her to work, even though she had been offered a job as a social worker. Like many men, my father felt that he would lose control over my mother if she became economically independent. He claimed that his earnings were adequate to meet the family's needs. At that time, my father's income would have been adequate had he not turned a "modern polygamist," one who did not respect his first wife, as opposed to the traditional polygamist who esteemed the first wife over and above his other wives, just when he reached the peak of his career with my mother's active support. My mother did not benefit at all from my father's career development, although she sacrificed her own career to look after the family. She complied with the cultural imperatives in becoming a wife and mother but suffered intensely for that compliance.

Growing up in such a home, I knew that men, including my brothers, had better chances of pursuing a career than I did. My mother's experience taught me that I had to strive as much as I could to exploit my potential and to acquire a career for myself before I decided whether I also wanted to be a wife and mother. I realized that I was growing up in a patriarchal society and I knew that I had to fight to break free from the stereotypical role set out for women that had trapped the women of my mother's generation.

Today a significant number of Kenyan women share my sentiment. More families in Kenya consider education for girls just as important as it is for boys. As a result, more women in Kenya have managed to break away from the role set out for them as wives and mothers and are achieving previously unimaginable standards of education and careers. Nevertheless, they are still involved in a struggle, one that is significantly different from that of my mother's: the struggle of balancing a career with motherhood. Social and cultural barriers still exist that tend to limit women's full participation in male-dominated spheres of education and employment. This study focuses on these women; the young women I interviewed represent the young aspiring career women that Kenya is witnessing today. The story that these young high school girls tell is one

of a struggle, one different from my mother's. Women today are aspiring to achieve the highest standards possible. The story that these girls tell shows their aspirations, and their fears—fears of the consequences of breaking away from the norm and concerns about barriers that stand before them and serve as obstacles to the full participation of women in science and science related careers. These barriers become obvious in the responses of the male students I interviewed. The picture that emerges from their responses indicates the general feelings and attitudes of society toward women in general.

In this chapter, the data in chapter 5 are interpreted in terms of two struggles. First, is the struggle that high school girls have in the study of science, within the classroom. This is exemplified by the reports of their experiences in science classes. Second, is the struggle to choose science as a career option and at the same time be a wife and mother. I will consider each struggle separately.

The students are presented as active participants in making sense of the dominant ideologies of gender that impinge on their experiences as female students studying science in mixed and single-sex schools, and later on their choice of careers. In this chapter, the school is seen as a medium through which dominant ideology is mediated through textbooks, through the assumptions that teachers use to guide their work, through the meanings that students use to negotiate their classroom experiences, and through the form and content of school subjects themselves (Giroux, 1981). The female students resist the dominant ideology and 10 of the 16 female students interviewed plan to break-away from traditional gender-specific careers. However, the other six female students do not see the possibility and the means of "emancipating" themselves from careers that are considered feminine. It is important to note that at Jogoo High School, a mixed-sex school, only two of the six girls taking pure science plan to pursue careers in science or science-related fields. However, three of the four male students interviewed aspire to pursue careers that are male-dominated. The social economic-status of the

two schools has some significant influence on the students' career aspirations especially in terms of the facilities.

Girls' struggle with school science

According to Giroux (1981), schools cannot be removed from the socio-economic context in which they are situated, for the essence of schooling lies within the nature of its relationship to those wider societal forces of which it is a part. He further stated that the school functions as an active cultural sphere both to sustain and resist the values and beliefs of the dominant society.

Many educational philosophies have been based on the premise that a good education is one that fits students for their place in the world, one which equips them for their future life (Spender, 1981). An examination of Kenyan educational history reveals that the provision of education to the youth according to their future roles in the society is not a new phenomenon. Various communities had their own form of traditional education that prepared the youth to fit and work within the coherent social organization of their people. In all the communities, the youth were prepared for gender-specific roles as adults in their society, girls were prepared to be wives and mothers and were taught specific feminine roles and the boys were taught specific masculine roles such as building huts and hunting (Sifuna, 1976). The formal educational opportunities made available to Africans by the Europeans were developed along gender lines, girls were taught feminine skills such as sowing, weeding, harvesting, weaving, and craftwork (Furley & Watson, 1978, p. 77).

Analysis of data on students' experiences with science education show differences related both to gender and school context. The picture that emerged in the schools in which students were interviewed was that the female students' struggle seemed to be influenced by identifiable factors. These include the sex ratio in a science classroom—a factor that proved intimidating to girls at Jogoo High School, the availability of facilities and equipment, the aggressiveness of boys in the class, and sexism in the classroom. Female students in Kega High generally expressed

positive attitudes towards science and further study of science at higher levels of education. In Jogoo High School, female students expressed apathy towards science. Four of the six girls taking pure science subjects did not see themselves going for higher education after high school; they all allege that science subjects are very difficult to understand. However, boys in the same class express more favorable dispositions towards science and, as a result, these male students plan to study science in the higher institutions of learning.

In 1963, Kenya became an independent country and inherited an education system from the colonialists that had developed along gender lines. Independent Kenya emphasized increasing the number of females at each level of education, but no explicit attention was given to females' choices of subjects to study in secondary school and university. Not surprisingly, girls continued to be encouraged to take arts subjects and the boys to take the more masculine subjects such as science, industrial and technical subjects. The facilities in schools were developed to cater for the subjects that were being offered. For example, in 1983 the distribution of science programs between boys and girls schools was found to be unbalanced; there were 113 science streams for boys but only 34 for girls and 35 for co-educational groups. Thus there were more boys schools than girls schools with adequate science teaching facilities (Eshiwani, 1988). Because of the long period of engendering school subjects, girls opting to study pure science subjects in high school and at university have been perceived as challenging the "normal" pattern for girls of studying the traditional feminine subjects by the students, teachers and parents. Female students at Jogoo High School taking pure science subjects alleged that they experienced pressure from boys who tended to assume superiority over girls in science classes. They noted that the boys created competitive learning environment that frustrated most girls (Atieno, Interviews 1 & 2, May 30 & June 20, 1989).

Virtually every school in Kenya lacks sufficient science equipment for proper teaching of the subject (Policy Conference, 1989). The inadequacy of science teaching equipment in Jogoo High School created unequal access to knowledge. During labs a subtle struggle ensued over access

to these limited facilities to do experiments. During the labs I observed, all the apparatus and chemicals were placed on a central bench from which students (working in groups of six) could reach them. Each group would try to get the apparatus and chemicals as soon as possible but girls were implicitly discouraged from rushing out for the apparatus and chemicals. Instead, the duty of recording the results was relegated to them. For the girls to rush out for the apparatus as the boys did, they would have to behave aggressively, and such actions would conflict directly with social notions of femininity. Smith (1988) noted that femininity is not simply an effect of patriarchal oppression, but that women become active and create a part in its social organization. Girls at Jogoo High School, as expected, chose to be passive during science practicals, even though they were aware of the importance of these labs in the understanding of science. The social construction of femininity catches girls in a contradiction. Female students have been found to use science classrooms as an opportunity to be feminine by posing around the experiments instead of taking part (Brewster, 1980). Shaw (1986) noted that co-education reduces the opportunity for individual equality.

The Government of Kenya has embarked on a policy of providing equal education and training opportunities to all areas of Kenya in an attempt to correct imbalances and disparities which existed at independence (Kamunge, 1988). This policy is partial in that it does not seek to address individual equality but area equality, and therefore it does not address gender inequalities in education, and in science education in particular. These inequalities, have been in existence since the introduction of formal western education by Christian Missionaries. As reported earlier, most boys schools have better facilities for the teaching of science than girls schools. In mixed-sex schools, there appear to be unchallenged factors that are assumed to be "normal practices" that lead to unequal opportunity to these limited facilities. The struggle the girls engage with is that of making sense of their experiences and weighing the forces and realities that face them if they continue to study science or drop science and make alternative career arrangements such as business careers most girls at Jogoo High School hope to pursue.

In Kenya, traditional teachings instructed girls to be gentle in manner, not to raise their eyes or voice when talking to men in public (Sifuna, 1976, p. 20). The image of female silence as appropriate is maintained by the technique of castigating women and girls for talking. In the presence of boys, girls' voices are hardly heard. For example, at Jogoo High School, I observed that girls spoke only when the teacher prompted them to answer a question, while boys did not hesitate to ask questions. As noted, although the physics teacher did not engage the girls in class, girls were consequently blamed for being silent in science classes (Omondi, Interview 2, July 13, 1989). Research has shown that in mixed-sex schools, boys dominate in classroom interaction and demand more attention from their teachers (Byrne, 1987; Spender, 1981). It is not surprising that girls at Jogoo High School remained silent in the physics class. They had no alternative but to keep quiet since the teacher directed all attention to the boys who, as Spender (1981) observed, become uncooperative if they are not given what they want. These different experiences girls and boys had tended to promote self-confidence and high esteem among the boys and undermined self-confidence and self-esteem among the girls. Some of the repercussions would therefore be that girls feel alienated in science classes and eventually drop science as soon as they are able. It is not surprising that these female students have turned their attention and interest from science subjects to business subjects which lead them to careers that are quint-essentially feminine. Spender (1980) noted that to be a silent woman is to be an accomplice in female subordination.

According to Lees (1986), what seems to steer the formal learning process in a sexist direction often stems from the presence of boys in the classroom, and their effects on teachers' attention and time devoted to girls, sexual harassment of girls and ability of girls to hold their own in competition with boys (p. 120). The sexist practices of the physics teacher described by the students appear to be similar to those that I had during the first two years of teaching in high school. Reflecting on my teaching it seems that I tended to encourage boys more than the girls and had high expectations for boys and had difficulties understanding why a boy got a low mark

in mathematics or chemistry but expected low marks from girls. Clearly, this is the attitude I took to my science classes and yet the apathy girls tended to have towards science frustrated me. The effects of and lack of expectations are crucial. Psychological, sociological and educational studies have amply pointed out that for all of us, the expectations of others play a significant role in our lives. Therefore as Spender (1981) pointed out,

> We should not underestimate the importance of absence of expectation in terms of women students; that teachers have so many (positive) expectations for boys, so many diverse expectations for their better students and so few expectations for girls could well be crucial. (p. 103)

The eventual consequence of the sexist practices and lack of expectations for girls by science teachers could lead to girls' apathy to science and to their poor performance in science examinations and girls' low enrollment in science and science-related careers. Sexist practices in school aggravate girls' struggle to study science in high school.

During the last 10 years in Kenya, the performance of students in general and female students in particular in science, mathematics, and English Language national examinations has been extremely poor. For example, in 1982, only 6.5% of all the girls who sat for the ordinary level mathematics examinations achieved a passing mark (Ministry of Education, Science and Technology, 1986; Eshiwani, 1988). It is not surprising that this pattern was replicated in the 1989 Kenya Certificate of Examinations even though the education system has been re-structured. Indeed, it was noted that the massive failure in these subjects was unprecedented (Ministry of Education, Science and Technology, 1990). Girls at Jogoo High School study science in an environment that is characterized by the reality of girls' failure to succeed in the struggle to study science in high school. It is a fact that most girls in this school who study science fail in the national examinations. These girls are presented with a model in which girls do not succeed in their struggle to study science in high school.

In 1989, for example, only 6 girls were selected to study pure science compared to 34 boys. The fact that a small proportion of girls in this school "qualified" to take pure science subjects in their third and fourth year of high school enhances the belief held by girls that science subjects are hard compared to other school subjects. General failure in national science examinations by most girls and at Jogoo High School in particular was interpreted by them as an indication of personal inability to do science and a "natural" pattern for most girls who opt to study science in high school. This could be the basis for the strongly held beliefs that girls in Jogoo High School expressed when they said that they believe that science subjects are hard but could not explain why these subjects are hard. Statements such as "I just believe that I cannot cope with science but I do not know why" (Njeri, Interview 1, May 30, 1989) are indicative of a fundamental deeply disturbing problem. The very low number of girls at Jogoo High School anticipating science-related careers is by itself an indication of the existence of a widespread problem that girls encounter in the study of science in high school.

In spite of the difficulties and discouragements that girls at Jogoo High School encounter during the study of science in school, two girls are not deterred from studying science in high school and anticipate to study science in university. These girls at Jogoo High School are determined to resist loosing the opportunity for higher education and entry into careers that seem to attract their male counterparts. Of the 10 Kega High School girls interviewed, 8 of them want to pursue careers that are science-related in university. The high proportion of students at Kega High School anticipating science-related careers suggest that these girls have more advantages in a single-sex school than their female counterparts at Jogoo High school. However, these female students are not ignorant of the demands that they will have to meet if they choose to pursue male-dominated careers.

The struggle between uneasy careers and intimate lives

The science education made possible to women in the western world today has been the result of the courageous struggles and hard-won achievements of women scientists of the past and present. In the period between 1820 and 1920, there was a rise of higher education and expanded employment opportunities for middle-class women in America. Women were permitted to gain the kinds of science education earlier available only to men, and to get jobs within the scientific enterprise (Harding, 1986). However, the opportunities available to educated women culturally created gender stereotypes. During this time as Rossister (1982) noted:

> Even as women's educational level rose and their role outside the home expanded, they were seen to be doing only a narrow range of "womanly" activities, a stereotype that linked and limited them to soft, delicate, emotional, noncompetitive, and nurturing kinds of feelings and behavior. At the same time, the stereotype of "science" was seen rhetorically as almost the opposite: tough, rigorous, rational, impersonal, masculine, competitive, and unemotional. In terms of nineteeth-century stereotypes of rhetorical idealizations, a woman scientist was a contradiction in terms. . . . Women scientists were thus caught between two almost mutually exclusive stereotypes: as scientists they were atypical women; as women they were unusual scientists (p. 61).

Women in the Western World have made attempts to enter science fields for more than a century. In spite of these attempts, the scientific workforce today is still obviously gender segregated (Harding, 1986). Women are still being assigned positions of low-status and channelled into "female ghettoes."

As noted earlier, the education opportunities made accessible to women in Kenya during and after the colonial period were gender biased. Kenyan women continue the struggle for opportunities made available only to their male counterparts. The career choice that a student makes is influenced by inter-related factors inside and outside the classroom. The possibilities

and constraints that shape students' career anticipations are partly a product of the expected norm of society for its members. According to Giroux (1981), schools institutionalize hegemonic ideologies and cultural messages which sets limits to the modes of discourse and social practices that mediate classroom experiences. Therefore, the school reproduces the acceptable members of society by providing different experiences to girls and boys in the classroom. The experiences that students have with science education in high school influences the students' view about science as a viable career. The students' views of scientists, their characteristics and activities influence the personal perception of the students' ability to study science and participate fully in science and science-related activities and meet the acceptable norms of society expected of each member.

Female and male students in this study hold the stereotyped image of a scientist as a man. Girls described scientists as great people who bury themselves in books, who do a lot of research and who have very little social life. This stereotyped image of a scientist as a man has been found to be prevalent among students in developed countries. For example when Chambers' (1983) Draw-a-Scientist-Test was given to 4,807 male and female students, only 28 pupils drew a scientist as a female. This stereotype is held by most students because of the domination of science and science-related careers by men. There are very few women who manage to enter into these careers. According to the students, the few scientists they have seen are mostly men and also, they noted that there is no record of women's contribution to science in science textbooks. The students' perception of a scientist as a man, and modern science as a man's domain, appeared to influence male and female students' views of their ability to do science in different ways. Female students at Jogoo High School who experienced difficulties in the study of science stated that they are not as capable of studying science and pursuing science and science related careers as their male counterparts (Njeri, Interview 1, June 6, 1989).

On the other hand, two female students at Jogoo High and all the 10 female students interviewed at Kega High School felt that they were just as capable of studying science as boys

and pursuing science and science-related careers (Mumbi, June 26, 1989). Consequently, these girls plan to study science in high school and in university against all the opposing forces.

The activities of scientists were seen by the female and male students as involving research to discover cures for diseases and make life better—as "battling phenomena." The activities were said to be demanding and involving. According to the students, these activities require resources that are made available to men by society by virtue of the sharp division of domestic labour. Time was noted as one of the major resources which is not easily accessible to women especially those who would also want to be wives and mothers. As a result of this, female and male students noted that a career as a scientist is not suitable for a woman who would also want to be a wife and a mother. Therefore female students stated that for a woman to pursue science and science-related careers, she has to be determined because these careers are challenging and also she will be expected to conform with the norms of society—become a wife and mother. Statements such as "if family life is what is important to you, then do not pursue science careers" clearly reveal that female students feel that balancing two roles that appear equally demanding constitutes a struggle to a woman but not to a man. This is because of the sharp division of domestic labour and the differential meanings that are attributed to parenthood. Spender (1981) made this point quite forcefully.

> While parenthood applies equally to both sexes, however, the meanings that are attributed to it are sexually differentiated, so that being a female parent—a mother is viewed as a very different role from being a male parent—a father. Motherhood is perceived as an ongoing activity, which begins, rather than ends, with the birth of a child, which demands years of a woman's life; whereas fatherhood is often confined to the mechanics of conception, a discrete activity which demands very little time. (p. 97)

Harding (1986) noted that society has appropriated the family as the proper sphere of women. By making the family a necessary institution, and by allocating domestic work to women,

this aspect of women's lives relieves men of the need to take care of their bodies or the local places where they exist, and frees them to immerse themselves in the world of abstract concepts. Therefore men were assumed to be the only ones who could become scientists. Hence as Abir-Am and Outram (1987) noted:

> For decades career guides have addressed young scientists (assumed to be men), and advised them that the one true path to advancement in science is through long, uninterrupted hours of concentrated work in the field or the laboratory with a minimum of social or family life (which can only distract them). (p. 1)

Girls who anticipate pursuing science and science-related careers in university consider these careers to be challenging as well as interesting. The careers they want to pursue are in engineering, architecture, various branches of medicine, actuarial science, and pilotage. These are careers that are dominated by men. The female students want to break out of the "normal pattern" of pursuing careers that are "feminine" which they considered boring and monotonous and attended by low remuneration. The girls expect their entry into science and science-related careers to be more difficult than boys' entry because girls will have to prove to their male counterparts that they are capable of pursuing careers that are male-dominated and at the same time remain feminine. They hope to build their identity as women and reinforce it by becoming wives and mothers. The male and female students subscribed to the notion of sharp division of domestic labour where the mother is primarily responsible for domestic work, child care and house keeping. However, the girls noted that this division of domestic labour intensifies a woman's struggle to balance a career and family life. Girls did not perceive their roles in the home being any different from those of other women. While the boys plan to pursue science and science-related careers, their choice is not problematic since they will not have to prove their ability to pursue science-related careers because it has become "normal" for men to pursue science-related careers.

Also, for male students, although family issues appear important to them, the sharp division of domestic labour favours their career development. They assume that they will get married and "settle down" to an uninterrupted work life. A study by Gaskell (1983) found that male students held similar assumptions about family life.

Because of the efficient internalization of these domestic roles, girls felt that men have been able to pursue science careers and have families at the same time. Talking about the nature of family life and implications for women, female students felt that men have been able to devote more time to developing their careers. Adhiambo (1989) stated precisely how women have been trapped by the sharp division of domestic labour and how men have used the opportunities granted them to advance in their careers and have families at the same time:

> Men have been able to to advance in sciences because they are not all that interested. All men want to have a wife and children to lean to in the future but they can afford to have a woman and children but not pay so much attention to them but a woman she knows that if she takes her career first and she would also want to have a family, chances are by the time she establishes herself with the career, all the men would be gone. So most of them take subjects which will allow them to fit in with their husbands life (Adhiambo, June 27, 1989).

Stories about spinsters and fairy tales of unfulfilment, can compel most female students to view maternal fulfilment more seductive than loneliness. Such students would steer away from careers that appear incompatible with wifehood and motherhood (Spender, 1982; Brewster, 1980). However, Adhiambo felt that family life was not important to her but the career she wanted to pursue was of paramount priority. Abir-Am and Outram (1987) stated that it is now a truism that women's careers in science face particular difficulties compared to those of men, and even special difficulties compared to those of women in other kinds of work (p. 1).

In Kenya, there is still a strong feeling that a girl who only goes to school to acquire "book learning," and later fails to marry, is not fully educated. Such a girl is a disgrace to her family and

to the community. This seems to be the reason behind the great concern mothers usually show in that in addition to formal education, daughters are equally exposed to, and fully acquainted with domestic duties. Because considerable pressure is put on a woman to get married and to have children, mothers try to prepare their daughters for the specific gender roles as adults in the society. The female students I interviewed stated that in Kenyan society, a girl who did not conform to this expectation was considered "abnormal," a cultural "rebel," and a bad role model. As a result, girls know that they are expected to "settle down" and have a family as Wambui (1989) stated:

> For many women after achieving what they want, they would like to settle down and have a family but once you find yourself achieving so much like being a doctor or a scientist, it becomes hard for you to join in the normal life. Men will look at you in a bad way and it wouldn't be easy for you to get somebody to marry you and all that and I know women fear that and the shame of remaining single. (Interview, June 27, 1989)

Therefore, although these girls plan to break away from the traditional feminine careers, and pursue male-dominated careers, there is considerable pressure to conform to the traditional and cultural gender roles—to be a wife and mother. These female students are caught between two conflicting consciousness: to exploit their talents by pursuing uneasy careers and also to conform with cultural imperatives and become wives and mothers. They recognized the difficulty that faces them in balancing the two demanding roles. Smith (1987) had the following to say about her experiences in the double life of a mother and career woman:

> These were two modes of consciousness that could not coexist with one another. In practice of course they "existed" within the same person, often in the same places, and certainly they often competed with one another for time. . . moving from one to the other was a real shift, involving a different organization of memory, attention, relevances and objectives, and indeed different presences. The strains and anxieties

> involved in putting and holding together work sites, schedules, and modes of consciousness that were not coordinated marked the separations institutionalized in a gender division of labor. (p. 7)

Balancing the two demanding roles is therefore not easy but constitutes a struggle to these female students.

Summary

Today the struggle in which Kenyan women are involved and to which I have made frequent reference is complex. Most importantly it reflects a number of factors of a social, cultural, educational and economic nature. For this reason, an examination of Kenyan women's "struggle" cannot be treated in isolation. It is like following two major strands through a tangled skein. These strands are school science sexism, and science careers and intimacy.

Kenyan women are involved in a struggle to gain a living and satisfy the social and cultural "worlds" they occupy (Johnson & Bernstein, 1984). The students' views of science as a career reveal the difficult position in which women find themselves, one that involves obtaining a high degree of achievement, breaking away from rigidly defined "female occupations" and gaining access to the male-dominated world of engineering, medicine and architecture. But how does one balance a "professional" career with motherhood? In many African societies, the woman's role remains primarily that of childbearer, rearer, mother and wife. It must be emphasized that men's entry into the labour force was facilitated by the sharp division of labour in the household. If women continue to receive "the short end of the stick," if present definitions of wifehood and motherhood remain uncontested, who remains behind in the household to bear, rear and care for children if women enter professions such as medicine and engineering? Are women "naturally" trapped in the childbearing function and therefore excluded from participation in social life on equal terms with men? This is the dilemma that faces Kenyan women when they choose a career and this is evident in the interviews with the high school students in Kenya.

CHAPTER 7

SUMMARY AND CONCLUSIONS

This chapter summarizes the study. Against a background illustrating the study's theme of Kenyan female students' views of science, the methodology is described. Then I review the specific research questions of the study, and a summary of the major findings follows. These are categorized according to the underlying factors that were found to perpetuate or suppress gender consciousness: female students' perceptions in co-educational and single sex schools, gender-relations in Kenya, and the struggle between uneasy careers, wifehood and motherhood. Recommendations based on the data and analysis conclude the chapter.

Methodology of the Study

This study explores Kenyan students' views of science, using qualitative research methods to collect interview data. Twenty students were interviewed, 16 females and 4 males. The study focuses on female students' views of science, with the views of male students providing confirmation and elaboration. As Smith (1987) has argued, it is appropriate to begin an inquiry from the standpoint of the subject. This is an inquiry that regards women's subjugated experiences as both starting and ending points. In Smith's terminology, this methodology makes the study *for* girls, not *about* girls. By asking girls and boys to describe their own experiences of school science education, I was able to understand the different cultural spaces that boys and girls occupy in schools and in science classes that result in experiences that differ according to gender. Eliciting the students' views of the characteristics and activities of scientists, women as scientists, science as a career option and family plans, I was able to explore the meanings and understandings that female students associate with science careers. It was immediately apparent that their sense of possibilities and constraints are constructed within the historical and cultural

context of Kenyan society. This method of inquiry was useful to me because I, as a woman, could identify with the experiences that these female students have in school, at home and in their peer group communities. Smith (1987) states that the importance of this method is that the voice of the subject of inquiry and the voice of the inquirer are culturally identifiable. Also this method enabled me, as an inquirer interpreting, explaining, and critically examining the girls' condition, to simultaneously explain my own condition from the standpoint of historically and culturally locatable subjugated experiences.

The Research Questions

In this section, the specific questions the study was designed to explore are reviewed in the light of the data that unfolded. The study set out to explore the following specific questions.

1. What discursive forms do girls use to describe science and scientists?
2. What are the reports of experiences that girls have of school science education; are these reports of experiences different from those experienced in other school subjects, and, if so, what reasons do they give?
3. What messages about their ability to do science and math do girls infer from their teachers? What are the students' views of these messages?
4. What are the girls' views about science as a viable career option?
5. Do the views expressed by the students suggest attitudes that could be associated with the historical and cultural legacy of Kenyan society?

Four major points emerge from the data, indicating that Kenyan students' experiences of science and of socio-cultural forces interact to influence their career choices. Firstly, the data show that these students hold the stereotyped image of the scientist as a man. Secondly, data show that girls and boys, especially in co-educational schools, have different experiences of school science education and receive different messages about their abilities to study science in

high school and to pursue science and science-related careers. These experiences of boys and girls in school and in science classes are fundamental in shaping the students' self-perceptions and setting an example for younger students. Thirdly, stereotyped images that students hold of scientists and their activities, and the experiences that students have in school science education, were also found to influence the female students' career anticipations. Fourthly, the images that students form of science, science as a viable career, and family plans are influenced by the historical and cultural legacy of Kenyan society.

The experiences that girls have with school science education, and the images these students have of science careers and the cultural imperatives that continue to require women to be wives and mothers primarily confined to the "private" sphere of domestic labor, condemn female students who aspire to science careers to a double life of struggle. Of course, it is important to bear in mind that Nairobi is quite different from the rest of Kenya. Themes and issues that are most apparent in Nairobi are likely to appear in subtle variations and growing intensity in other locations as social and cultural developments spread outward from Nairobi.

Impact of Co-educational and Single-sex Schools on Girls' Perceptions

The factors that lead to the under-representation of women in science and science-related careers are intricate because as Lewis (1989) observed, the ways in which women's constraints and possibilities are constructed are deeply complex and these constraints and possibilities are not always easy to unpack (p. 121). However, this study shows that boys' and girls' experiences of school science education differ in specific and gender-related ways. These differential experiences affect boys' and girls' self-perception of their ability to study science in high school and to pursue science and science-related careers in different ways. In Jogoo High School, a co-educational school, where the number of female students studying science is low, the girls experienced more explicit gender biases. The girls in Jogoo High school alleged that they studied science in a competitive and "fearful" environment. In this environment, the girls claimed that

boys dominated the classes and felt superior to the girls. Most science teachers seemed to be unaware of the "fearful" environment experienced by girls in science classes in this school, instead girls were blamed for not participating in science classes and for their poor performance in these subjects. Therefore, studying science at high school for these girls is a struggle—a struggle that as one girl observed, many girls give up. This helps to explain why so many girls studying pure science do not view careers in science as viable. Also, girls at Jogoo High School appeared to get no support from their teachers in their struggle to study science. This was demonstrated by the students' unwillingness to seek help from their teachers when having difficulty in science (Njeri, interview # 1 May, 1989). According to Giroux (1981), the struggle for viable educational alternatives will move forward more quickly once human agents are located within the center of such a task. Therefore, the role of the teacher in assisting girls to resist the cultural imperatives of society and school and to make choices for themselves that do not continue women's subordination in the family and in the workplace is crucial.

According to Spender (1981), most teachers are not aware of their gender biases in class because sexism is so pervasive and embedded in our ways of looking at the world that we are sometimes unaware of the extent to which it controls our actions. Consequently, even when we feel that we are being fair, or showing "favouritism" to the girls, empirical evidence can indicate otherwise (p. 56). Spender (1981) also noted that:

> whenever males are present, males are in "control" and even they are able to control teachers indirectly. As a result, female students stand in subordination both to teachers and to their male classmates in most conventional co-educational classrooms. (p. 118)

Therefore, co-educational schools have been criticized for being unsuitable to girls because girls interests are sacrificed for the interests of boys (Eshiwani, 1983; Brehony, 1984). In spite of this, consequences of co-educational schooling to girls seem to be ignored by educators and its proponents. Brehony (1984) concluded that co-educationalists of the early 20th century lacked

any recognition of the deep-rooted nature of male dominance over women in society and the cognitive outcomes or implications of co-education were largely ignored (p. 35).

On the other hand girls at Kega High School reported positive experiences of school science and held more egalitarian views about women's ability to pursue science-related careers. They perceived themselves as capable of pursuing science and science-related careers. These girls perceived pursuance of careers that are male-dominated as a form of "emancipation" for themselves from careers that are pursued by women, that are characterized by low pay, poor working conditions and dependence. These girls got direct and active support of the teachers, peers and parents to choose careers that do not continue women's subordination in the family and in the workplace. Despite this, girls at Kega High School hoped to conform to the cultural expectation of becoming wives and mothers as well. They expected the two roles to be pressurizing. Nonetheless, the process of choosing to pursue science and science-related careers exposes the struggle, the weighing of forces, and the problems associated with this choice.

Investigators in western countries argue that all-girls schools can have a beneficial effect upon girls' performance as there is less pressure for girls to conform to gender-typed classroom behaviour when boys are not present (Deem, 1978). Support for this position comes from a study of schools in Kenya (Eshiwani, 1983) which found that girls in single-sex schools performed better in science than girls in mixed-sex schools. Eshiwani concludes that "these results suggest that any intervention strategy for the improvement of science education among girls should steer clear of co-education" (p. 47). However, at the same time boys' schools had better facilities, better-qualified teachers, and offered more science options (Eshiwani, 1988; Duncan, 1989).

Therefore it appears that girls in Kenya do not have equal educational opportunities made available to them by the educational system that proposes to develop an egalitarian society by availing equal opportunities to every Kenyan regardless of race, sex or creed. This national

education system falls short of its aims of removing social injustice and disparities between sexes, regions, social and economic groups (Kamunge, 1988).

A View of Gender Relations in Kenya

Girls' struggle in school to study science and to pursue science and science-related careers cannot be isolated from wider women's struggle in the public. An examination of gender relations in Kenya show that the supremacy of men over women is very well articulated in Kenyan Society. In Kenya, women who have tried to challenge the position of men in patriarchy on matters relating to women's rights have been subjected to a variety of public attacks by men. Politicians have been at the forefront reacting to the challenge from women with affront and soliciting support from all other members of the male-dominated parliament where there are only two "silent" female members. For example, one female rights protagonist, who is also the first female professor of veterinary medicine, has occasionally been described as a villain whenever she has challenged men's supremacy in the making of decisions that are gender biased and also that affect the environment. She has been discredited by politicians and has been accused of being misled by western feminist ideology. The activities of the non-governmental environmental movement of which she is the chairperson and herself have been subjected to scrutiny for national "security" reasons (Kenya High Commission Press Review, March 7, 1990). These public derogatory remarks that remind this woman of her place in society "as nothing else but a woman" (to use a common Kenyan phrase) influence the views of women in Kenya about themselves and of the young girls in high school as they endeavour to pursue careers that are male-dominated and influence their anticipations of their role in society. It is not surprising that girls at Kega High School expect to be discriminated against in getting jobs if they pursue careers such as mechanical engineering and also expect to be viewed as being unfeminine—trying to be like men (Wambui, June 26, 1989).

Attacks on women that seem to draw support from the ruling apparatus delineate the status of men and women in Kenya. These attacks become the headlines in Kenya's three local newspapers read by over 1.5 million people daily. The active opposition mounted by men, usually politicians who often claim to be speaking on behalf of their constituents, in condemning "bad elements" confirms the existence of a general feeling that men are superior to women in all ways. The images of women as inferior and powerless that are portrayed by men, influence women's self-perception. These images narrow women's horizons as to what extend women can be like men and be treated as equal to their male counterparts. Indeed, it appears that Kenyan society by and large perceives women as subordinate to men and not capable of pursuing careers that are male-dominated.

In schools, these attitudes towards women seem to be carried on since the cultural and social life of the school is not insulated from that of the family and the neighbourhood. School life is an aspect of social life in general. As Lees (1986) noted, the social life of the school is not divorced from the social life after school hours and at weekends in the family and the neighbourhood. Girls at Jogoo High School a co-educational day school are likely to be more affected by the cultural and social life of the family and society than girls at Kega High School, where the school life is relatively insulated from that of the family and society because these girls are admitted into the school from all over the country and almost all of them are boarders. The time these girls spend interacting with the social phenomena described earlier is less since girls in boarding schools spent three quarters of the year in school and therefore removed from the larger culture on a daily basis.

In Kenya, at a national level, there is considerable pressure on women to become wives and mothers. The government's policy that pays a house allowance to single female civil servants until age 27 is one such move. After age 27, single female civil servants are not eligible for the house allowance since it is assumed that they should be married and under the care of a husband. Their single male counterparts continue to be paid their house allowance for as long

as they remain in government employment. As reported, some female students felt that they had to consider the careers they wanted to pursue since their parents expressed doubt about their ability to complete the programs and fit into married life. The pressure put on these girls by their parents and society to reconcile themselves to marriage, limit their career horizons. Therefore, with all the changes that have taken place in Kenya towards the establishment of an egalitarian society, the fundamental structures that continue women's subjugation remain unchallenged. The policies that claim to bring equality to all people irrespective of sex remain in theory but not in practice.

Recommendations and Implications of the Study

This study has shown that there are uncontested factors that lead to female students' exclusion from science. These factors can be traced to the historical, cultural and economic legacy of Kenyan society. The school as a social institution is responsible for the suppression or perpetuation of gender-role stereotypes by providing different experiences to students. This study shows that male and female students at Jogoo High School, a co-educational school, have different experiences of school science education. These experiences encourage the boys to study science in school and to pursue science and science-related careers after their schooling. For the girls, the experiences create apathy towards the study of science and they are channelled to non-science related careers that are dominated by women.

It is significant to note that stereotypes of what is "natural" and "acceptable" role for each sex create subtle barriers to the full development of intellectual abilities even when academic access is unlimited. Culturally-imposed sex roles and constraints shape self-images, attitudes, and ambitions. In all cultures, the treatment teachers give to subjects in the curriculum and their reactions to students of both sexes can help to suppress bias or to perpetuate it. Science teachers should be particularly cautious of their treatment of students and of science subjects.

Teachers should be made aware of the subtle and often hegemonic ways in which these biases are perpetuated.

The study also shows that girls in Kega High School, a single-sex school have more positive experiences of school science education and anticipate to pursue science and science-related careers. However, these girls noted that they were not aware of the science-related careers open to them. Therefore, in the educational sphere, improved career counselling to advise and encourage girls would be an important support to girls. They need more than just a list of science careers and educational requirements for obtaining those careers. Also, there is need to change cultural attitudes towards domestic labour and the role of a wife and mother. These attitudes impinged on female students' career aspirations, limiting the students' career horizons and reconciling them to the realities of living double lives of career, family and motherhood.

Additionally, because of the evidence available that girls in non-co-educational school have positive experiences of science education, and because of the evidence that there are fewer secondary schools for girls than boys, special effort should be made to open more government girls' secondary school that have the necessary science teaching facilities.

Although the 8-4-4 system of education was adopted to improve students' performance in science subjects at the secondary level, the 1989 results showed unprecedented mass failures in mathematics, science and English language (Kenya High Commission, March 1, 1990). This shows that making a course mandatory does not result in the intended outcomes unless practices and attitudes also change, transforming social practices that are taken for granted. This study demonstrates the power of qualitative research methods in making visible the students' everyday world from their own standpoints. Therefore it is recommended that further studies be conducted using similar methods of data collection. These would provide additional information to science teachers, curriculum developers and educators about students' views of science, continuing the

search for ways to redress the observed female students' exclusion from science. This approach makes change more open to human agency.

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Appendix A. Jogoo Interview 1, May 30, 1989

This interview was conducted between the researcher (MN) and a female student at Jogoo High School. This interview shows that despite the fact that this student is presented with an unsuccessful model in science, she is determined to succeed in studying science at high school and to pursue a science-related career in university. (In the interviews, ellipses indicate pauses.)

MN: I am a graduate student at Queen's University, Canada. Before I went to Canada, I had been teaching at Pangani girls High School. My teaching subjects were mathematics and chemistry. I am here so that we can talk about your experiences in school, your views of science, career aspirations and others things that you might want to discuss with me. I am interested in female students' views of science and what experiences girls have of science education. Maybe for a start you can tell me something about yourself and your experiences of science.

ATIENO: It is something we've really discussed with our friends, actually the picture that girls have taken about science subjects is that they cann't manage it, according to us when I was coming to form one, my sisters they used to say that science is a difficult subject meant for boys only. When I came I got that picture of maybe I couldn't manage it. Also there are some things that girls find that they can't do. For example, like in biology, sometimes we do ecology like climbing up trees and it is not easy for a girl to do such work.

MN: Why do you feel that it is not easy for a girl to do such?

ATIENO: It is something that has always been there they get the information from other people who have already done it, it is what we learn from others.

MN: Others like who?

ATIENO: Our friends who have already done the work, they find it very difficult for girls, so they try to persuade the younger ones that science is very hard or difficult, don't try it and don't choose it for a career. In other words, try to avoid it.

MN: Why?

ATIENO: Mostly girls do not make it if they take sciences, they just take a picture like that.

MN: Why do you think it is the girls, where do they get this information from?

ATIENO: Maybe from the results the others get, examination results in which most boys pass well and most girls do not pass as well. This tends to make the girls feel that the men are just tough, tougher than the girls.

MN: So men are tough?

ATIENO: Mmmh

MN: Do you think that science is also tough?

ATIENO: Yes it is also tough, but then they tend to take it as if girls cannot make it, those who've tried have failed.

MN: So do you mean to say that those girls who've done science and failed tend to warn the rest about the risk they are taking if they opt to do sciences?

ATIENO: Yes, and also people they tend to find girls as an inferior sex in our society, this is something that has always been in the society.

MN: Where do you think this feeling comes from, the feeling that girls are inferior?

ATIENO: It is just something that has been there before.

MN: Before what?

ATIENO: From our ancestors.

MN: Do you think that it is something cultural?

ATIENO: Yes, they thought that women are weak, they couldn't do some things and they were just ignored.

MN: In those days women did not have to go to school or the men, we didn't have science as such.

ATIENO: Yes there was no science but then they took women as if they are weak and not capable of doing tough work.

MN: Tough work like what?

ATIENO: They thought that women couldn't think to the same extend as men. Actually in the family, they felt that women shouldn't make decisions and their thoughts were limited and what they could do was also thought of as limited.

MN: You said that women were thought of as being weak, they couldn't make decisions and participate in doing tough tasks. Do you feel that this feeling could have any relationship to the present view of science as tough?

ATIENO: Yes. It also applies to that according to the current society girls and women take things for granted, they just ignore.

MN: So do you feel that this inferiority feeling or the treatment of women as though they are inferior in the society has made women feel they are not capable of studying science?

ATIENO: Yes. It is the same thing, they take it for granted that since other people say that we can't make it, then why try.

MN: Who are these other people?

ATIENO: The influences from the society.

MN: Who in the society?

ATIENO: Mostly friends and those people who have already done it before.

MN: Can you say that there is a particular group of people who discourage the girls?

ATIENO: It is mostly the girls who discourage the others. Also the boys try to challenge the girls and the girls feel that they cannot manage.

MN: The boys challenge the girls who study science?

ATIENO: Yes. They challenge us so much.

MN: How do they challenge you, or in which way?

ATIENO: In case a girl performs better than the boys in science, the boys ask themselves "how can this girl defeat us?" They do not like defeat. So they come and challenge, so with all other challenges, the girls just give up.

MN: The challenge from the boys make the girls give up?

ATIENO: The boys wonder how can a girl defeat us? So they try to give a tough challenge.

MN: How do they do it?

ATIENO: They work even harder than the girls and when the girls see that they are being defeated, they just give up.

MN: Is this information from your personal experience or from what you have heard other girls say?

ATIENO: Yes.

MN: Are you saying that if you opt to do sciences the boys feel that you are infiltrating into their "territory"?

ATIENO: Yes and they work harder so that they defeat us and make us failures in some way. They wouldn't like us to be superior to them.

MN: Do you therefore feel that a boy will view any girl taking sciences as trying to be superior?

ATIENO: Yes and therefore they try to challenge us. Challenge us by trying to compete with us.

MN: You said that the boys work harder so as to defeat the girls. What makes the girls not to work harder as well?

ATIENO: The girls tend to give up easily.

MN: Why do they have this tendency to give up easily?

ATIENO: It is natural. It is just in them.

MN: Why do you refer to girls as "them"? Do you mean that it is also in you to give up?

ATIENO: We tend to give up easily. Maybe in a struggle we don't tend to fight harder.

MN: In other words we are not fighters is that what you mean?

ATIENO: For example, when we are doing something, we tend to give up easily.

MN: Do we give up when we do not get the results or when do we give up?

ATIENO: We tend to like to obtain much.

MN: Is it that we want to get results easily without having to struggle?

ATIENO: Yes. We tend to take things as if they come easily and if we don't get them, we tend to give up easily. We don't like struggling much like boys would do.

MN: Why do you think the boys would put up a struggle more than girls?

ATIENO: They do not like defeat from girls.

MN: Is it that they do not accept defeat from girls only

ATIENO: They would do so if there is a boy trying to challenge them, but it would be more if it were a girl trying to defeat them. They tend to put a struggle against girls in a mixed school.

MN: How do you relate to the boys in the class. For example, when you are working in class or doing experiments?

ATIENO: Like in our class, according to what we do, maybe when the teacher asks a question maybe he should find that the girls tend to know more, the boys try to challenge us next time not to see a girl defeat them. We girls try to put up more effort but then according to the kind of pressure outside, according to the work we do when we go home, boys are less occupied with home work therefore they have a lot of time and they use the time to work on the assignments they are given at school. Us girls we have a lot of work to do. We've got . . . so much of our time is taken up doing household work. We tend to get less time for our school work unlike the boys. Our time is limited and we cannot challenge them as much as they can do.

MN: What about if you were in a boarding school. Do you think the situation would be any different?

ATIENO: It would be different but then girls tend to relax. If they don't have challenge, they've got this weakness in them. They don't like working hard.

MN: Why do you think that most girls do not like working hard?

ATIENO: I haven't thought of that.

MN: Maybe you could think about it and we talk about this next time we meet.

ATIENO: Maybe it is because they've got a lot of problems to think about.

MN: What problems are these?

ATIENO: (silence). Like social problems.

MN: Maybe then you could think about these social problems and then we will talk about them later. Which subjects are you doing now?

ATIENO: I am taking chemistry, physics and biology and the other six are the compulsory ones.

MN: So the subjects which you chose for yourself are the first three?

ATIENO: Yes.

MN: What can you say about the subjects of your choice?

ATIENO: I like it, although we did not make the choices ourselves as such, the teacher decided it but I like it, I like it all.

MN: Are you doing well in them all?

ATIENO: Yes.

MN: What in particular do you like about your subjects?

ATIENO: My aim . . . my career . . . I want to be a doctor so I really like the subjects and I'm working hard so as to obtain my career.

MN: So you want to pursue a science-related career?

ATIENO: Yes.

MN: How do you find maths?

ATIENO: It's hard but I know I have to work hard.

MN: What do you mean by saying that maths is hard?

ATIENO: Ahh . . . in the working of maths, you need to know much about it.

MN: What do you mean by knowing much about it?

ATIENO: The tactics of how to go about solving the problems?

MN: Is it that we as teachers or math teachers we don't explain it too well or there is something mysterious about math in which one needs to know to be able to solve maths problems?

ATIENO: You know the teachers do it properly but then the task remains to us, maybe it is because we do not do enough revision because of the other subjects and also not having enough time for each subject.

MN: Do you feel that to do well in maths you need more time than in the other subjects?

ATIENO: Yes particularly maths and the science subjects are the ones that need more time.

MN: Do you feel that the arts subjects require less time to study and to pass?

ATIENO: Yes I feel that to study science subjects, you need more time than the arts.

MN: Therefore you feel that time could be one factor which limits girls' performance in these subjects?

ATIENO: Girls tend to do a lot of work at home than boys. Boys just do a few things like slashing grass or washing a car which are not daily duties. Girls have work which has to be done regularly on daily basis and not just once in a week.

MN: Therefore there are girls roles and boys roles. Who divides these duties?

ATIENO: Our parents arrange who to perform the particular duties.

MN: Do you think that our parents do not take into account that the girls sit for the same exams as boys and they continue dividing household work along the traditional lines?

ATIENO: I feel that they tend to ignore the fact that boys and girls do the same exam. I feel that the parents have a part to play in discouraging girls from participating fully in schools. The roles they have to play are tiring such that by the end of it one is so tired and unable to do their school work.

MN: Atieno, do you have anything more you would like to say?

ATIENO: Nothing.

MN: Thank you very much for now. We will continue from here next time we meet.

Appendix B. Kega Interview, June 26, 1989

The following material is from the interview between the researcher (MN) and a female student at Kega High School. This interview shows that the student is aware of the existing gender-role stereotypes and she is determined to "emancipate" herself from these cultural expectations and pursue a career that is male dominated. Also, this student does not expect to comply with the cultural expectation of becoming a wife and a mother.

MN: What subjects are you taking?

ADHIAMBO: I am taking the five compulsory and then chem, bio, physics, CRE and French.

MN: What can you say about the subjects you are taking?

ADHIAMBO: I enjoy them especially the science subjects.

MN: What about them do you enjoy?

ADHIAMBO: I like sciences because they bring up the facts of nature, they do not beat around the bush. They also help me understand more about God's creation . . . the wonders that naturally I can not understand, they also give concrete prove to every day events.

MN: How do they do this?

ADHIAMBO: I mean like in the . . . man breeds . . . not even that but also how life starts from . . . a tiny let's say a dot of life and how it stays in the womb and he begins to grow and grow. If you take a subject like history, it does not explain why things are the way they are but science brings out logically why things are the way they are.

MN: Why else would you say you like the sciences?

ADHIAMBO: I would also like to pursue a related career in sciences.

MN: Which one?

ADHIAMBO: Engineering.

MN: You want to do engineering and I thought that you would like to do music since you are very interested in music?

ADHIAMBO: Music will just be like a hobby, relaxation but emh . . . I will not take it seriously.

MN: But why not?

ADHIAMBO: Because there are so many musicians and music you can do it as a hobby but science you can't really.

MN: Why do you want to do engineering?

ADHIAMBO: Because for one it is very challenging and I will work with non-living things and . . . ammh

MN: Why do you want to work with non-living things?

ADHIAMBO: Because I find it easier to relate to things that are not living. I do not know but it is just the way I feel. Generally I like physics and chemistry and maths and I do not like biology very much.

MN: Do you feel that you fear the living things handled in biology?

ADHIAMBO: Not really but when you are dealing with non-living things you are not dealing with someone's emotions you are just dealing with substance and so you do not have to bother which impact you are having on that thing.

MN: Why would you want to take something that is challenging?

ADHIAMBO: Emh I don't like things which are monotonous that . . . I like seeing new things in life. I mean I don't think I will fit in well with something that I have to memorise that I know that today I am going to do this and the other, that's how it is going to be today and the day after. But in engineering I get to go around and see different aspects.

MN: Yes. I think there will be always something new to be done. A new machine to be repaired, a new technology and all that.

ADHIAMBO: Mmmh . . . and one can advance more.

MN: What are some of these careers that you would consider monotonous?

ADHIAMBO: Teaching . . . and things like secretarial work.

MN: But these are some of the careers which attract many women?

ADHIAMBO: I think it depends on the individual but I don't think I would like such a life. I think most women are weak and they give in too easily, that's why they go for the easy jobs which they hope will offer them security . . . they know I will do this from 8:00 a.m. to 4:00 p.m. Engineering I don't think they like it because it is not really secure because you have to make decisions on your own but teaching everything is laid out there for you. There is no challenge because you are teaching things you've gone through before so many times.

MN: Why do you think women like things which are not challenging?

ADHIAMBO: I think is because we easily accept defeat, not really but we accept to be the weaker or to take the lower part in society because men try to look bigger like they are the leaders in our society. I think women are weak and decided to fit in with what men want so they just go a long with what men plan for them and they do not want things changed.

MN: What makes you think it is the men who plan for women?

ADHIAMBO0: I mean, let's take . . . generally it is the man who decides we are going to do this and that. The woman might put little suggestions here and there but the man will have the final say. I mean everywhere the top leaders are men and especially in the government there are very few women and if there are any they are usually below men.

MN: Where do you think this feeling of superiority for the men and inferiority for the women comes from?

ADHIAMBO: Maybe it is just part of our backgrounds, we have been brought up to think that men are more superior and more important. Like in a family, sons are valued more highly than the daughters. This is basically African traditions.

MN: One finds that in most science careers like engineering, there are more men than women. Do you think that the fact that men were given a chance to go to school before women has an effect to the number of women in these careers?

ADHIAMBO: I would say so because they were given chance to advance and to exploit their potential . . . they took the better career opportunities, they snatched them so women had to get by with the left-overs of the careers.

MN: What do you think are the activities of scientists?

ADHIAMBO: I do not know many scientists but from what I have seen mostly they bury themselves in books and get to research and expound on their knowledge . . . but I don't really think they have much of the social life if any.

MN: Why do you think they do not have much of the social life?

ADHIAMBO: I do not see them having any time and if you look at them I do not think they are very social people. They do not get along with other people and mostly if they get partners I think they find it hard to live with them . . . [we both laughed]

MN: So you think they do not have a good life with their spouses?

ADHIAMBO: Yes.

MN: It therefore seems like that it is not a good career [science] to pursue if you want family life?

ADHIAMBO: I think it depends on the individual . . . I mean if you think that family life is most important I don't think . . . but you can try but I don't think you'll be able to do as well. I think this is one of the reasons why men have been able to to advance in sciences because they are not all that interested. O.K. all men want to have a wife . . . [interrupted by somebody closing the windows in the laboratory] . . . and children to lean to in the future but . . . they can afford to have a woman and children but not pay so much attention to them but a woman she knows that if she takes her career first and she would also want to have a family, chances are by the time she establishes herself with the career, all the men would be gone. So most of them . . . take subjects which will allow them to fit in with their husbands life.

MN: In the light of this, do you see women being capable of becoming scientists?

ADHIAMBO: I think if they are very determined and they have the priority then . . . it also depends on the spouse if the man is this type of "macho" men I mean who won't understand and their views . . . I mean.

MN: What do you mean by macho men?

ADHIAMBO: Men who do not . . . let's say the man might not be working in a science related career or he doesn't feel like he can bend to have his wife go most of the time when she is doing her research or he does not feel that after all she is the weaker sex. I think it depends on the husband a lot if he is ready to go along with what the wife wants.

MN: Do you see most husbands being willing to do that?

ADHIAMBO: No. Not in the African setting.

MN: What do you consider to be scientific knowledge?

ADHIAMBO: I think scientific knowledge is emh . . . is the knowledge about our everyday life that is obtained through experiments and that's how scientists prove things instead of bringing up ideas from nowhere but they prove them scientifically through experiments and observation and it involves all spheres of life from the earth and the way human beings live.

MN: At any time in life, will you have a family?

ADHIAMBO: I don't think so actually or, I might if the right man comes walking down at the right time but since such fairy tales don't happen these days I really don't think so.

MN: Why?

ADHIAMBO: Well, maybe it is part of my nature but . . . men are not that bad but I would rather have a fulfilling career than sit around day and day . . . such a monotonous way of life. I would like to be fulfilled personally but if I got the type of man who is willing to sacrifice and who understands what I want, I mean it's O.K. To me I do not think it is an essential part of life, I can go through life without it.

MN: I think . . . in my understanding, engineering is a science career. Do you see yourself having to bury your head in books for the rest of your life and being anti-social?

ADHIAMBO: Well not really and that's one reason why I am interested in music. I will not bury myself or hide myself from the society. I would like to be part of the society and enjoy life as well not just concentrate on books because after all you can get all the knowledge you want but if you don't know how to live and relax and you enjoy yourself I think you do not know the meaning of life.

MN: Do you think that the unsocial nature of scientists could discourage most women?

ADHIAMBO: Yes it might. Because I think women are basically more social and they concentrate more on the social basis of life and not so much intellectual like getting together meeting friends and exchanging ideas.

MN: Do you think that this might be one of the reasons which make women to pursue careers which involve handling people like nursing, teaching.

ADHIAMBO: Yea because it gives them a chance to interact with different people and show their emotional affection and instincts.

MN: Do you see a man marrying a woman who is earning more than himself?

ADHIAMBO: I think it depends on the man, but . . . I know they are many but if I got a chance to speak to a man who feels belittled by the fact that his wife is earning more than himself I think I do not really agree with that because what is in a salary, you are still a man . . . no one has undermined you, you are still the bread winner . . . it might just be due to circumstances. No one has taken part of your manhood or your ego away from you. He should be still proud of himself.

MN: But he might feel that his role is being taken by the wife if she has to meet all the financial problems of the family?

ADHIAMBO: Well I think that this man is suffering from a superiority complex. First of all he married that woman and they should be meeting these situations jointly. That should not matter so much if the woman earns more.

MN: Do you see a man marrying a woman who is not working?

ADHIAMBO: The society today is and depending on the economical status of the country today, very few families can survive on one income it offers much more security and maybe one is sacked there is still something to lean on. I think the man feels better knowing that there is another salary coming and for the woman's security is important to work.

MN: Do you have anything more you would like to say?

ADHIAMBO: No.

Vita

PERSONAL INFORMATION

Name: Mutindi Mumbua Kiluva Ndunda

Place and Year of Birth:
Machakos, Kenya, 1958

EDUCATION

1973-1978 Kenya High School, Nairobi

1979-1983 University of Nairobi, B.Ed. (Science, with Honours)

1988-1990 Queen's University, Master of Education

EXPERIENCE

1983-1988 Graduate Teacher, Pangani Girls School, Nairobi

1989-1990 Research Assistant, Queen's University

AWARDS

1988-1990 CIDA-Goverment of Kenya Scholarship, Queen's University

1989 International Development Research Centre Research Grant (Women in Development)